

Annual Site Environmental Report for Tonopah Test Range, Nevada and Kauai Test Facility, Hawaii



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Prepared by
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Albuquerque, New Mexico 87185

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SAND 2005-4628
Unlimited Release
Printed September 2005

Calendar Year 2004
Annual Site
Environmental Report
Tonopah Test Range, Nevada &
Kauai Test Facility, Hawaii

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ABSTRACT

Tonopah Test Range (TTR) in Nevada and Kauai Test Facility (KTF) in Hawaii are government-owned, contractor-operated facilities operated by Sandia Corporation, a subsidiary of Lockheed Martin Corporation. The U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA), through the Sandia Site Office (SSO), in Albuquerque, NM, manages TTR and KTF's operations. Sandia Corporation conducts operations at TTR in support of DOE/NNSA's Weapons Ordnance Program and has operated the site since 1957. Westinghouse Government Services subcontracts to Sandia Corporation in administering most of the environmental programs at TTR. Sandia Corporation operates KTF as a rocket preparation launching and tracking facility. This Annual Site Environmental Report (ASER) summarizes data and the compliance status of the environmental protection and monitoring program at TTR and KTF through Calendar Year (CY) 2004. The compliance status of environmental regulations applicable at these sites include state and federal regulations governing air emissions, wastewater effluent, waste management, terrestrial surveillance, and Environmental Restoration (ER) cleanup activities. Sandia Corporation is responsible only for those environmental program activities related to its operations. The DOE/NNSA, Nevada Site Office (NSO) retains responsibility for the cleanup and management of ER TTR sites. Currently, there are no ER Sites at KTF. Environmental monitoring and surveillance programs are required by DOE Order 450.1, *Environmental Protection Program* (DOE 2005) and DOE Order 231.1A, *Environment, Safety, and Health Reporting* (DOE 2004b).

Calendar Year 2004 Annual Site Environmental Report
Sandia National Laboratories, Tonopah Test Range, Nevada &
Kauai Test Facility, Hawaii
Final Approval date: August 2005

Work performed under Contract No. DE-ACO4-94AL85000

Prepared for:

U.S. Department of Energy, National Nuclear Security Administration
Sandia Site Office, Albuquerque, NM

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ACKNOWLEDGMENTS

We wish to thank the following individuals who contributed their time and expertise assisting in the production of the TTR and KTF annual reports:

*Karen Agogino
Brenda Bailey-White
Linda Bayliss
Joe Bonaguidi
Kevin Cabble
Michael du Mond
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*William Forston
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Heidi Herrera
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Jennifer Payne
Stephanie Salinas
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NOTE TO THE READER

The goals for the TTR and KTF Annual Site Environmental Reports are to present summary environmental performance, compliance with environmental standards and requirements, and to highlight significant facility programs. In addition, DOE views this document as a valuable tool for maintaining a dialogue with our community about the environmental health of these sites.

We are striving to improve the quality of the contents as well as include information that is important to you. Please provide feedback, comments, or questions to:

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ACRONYMS AND ABBREVIATIONS

A	AEA	Atomic Energy Act
	ACM	Asbestos Containing Material
	AEC	U.S. Atomic Energy Commission
	AIRFA	American Indian Religious Freedom Act
	AQC	Air Quality Compliance
	ARPA	Archaeological Resources Protection Act
	ASER	Annual Site Environmental Report
	AST	aboveground storage tank
B	BLM	U.S. Bureau of Land Management
	BMD	Ballistic Missile Defense
	BMDO	Ballistic Missile Defense Organization
	BMP	Best Management Practice
	BSA	Bulk Storage Areas
C	CAA	Clean Air Act
	CAAA	Clean Air Act Amendments
	CAS	Corrective Action Site
	CAU	Corrective Action Unit
	CEMP	Community Environmental Monitoring Program
	CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
	CFR	Code of Federal Regulations
	CIS	Chemical Inventory System
	COD	chemical oxygen demand
	CV	Coefficient of Variation
	CWA	Clean Water Act
	CY	calendar year
D	D&D	decontamination and demolition
	DMR	Discharge Monitoring Report
	DoD	U.S. Department of Defense
	DOE	U.S. Department of Energy
	DOE/AL	U.S. Department of Energy, Albuquerque Operations Office
	DOH	Department of Health
	DRI	Desert Research Institute, Water Resource Center, University of Nevada System
	DU	depleted uranium
E	EA	environmental assessment
	EDE	effective dose equivalent
	EHS	extremely hazardous substance
	EIS	Environmental Impact Statement
	EM	Environmental Management (Department)
	EMS	Environmental Management System
	EO	Executive Order
	EPA	U.S. Environmental Protection Agency
	EPCRA	Emergency Planning and Community Right-to-Know Act
	ER	Environmental Restoration
	ERDA	U.S. Energy Research and Development Administration
	ES&H	Environment, Safety, and Health
	ESA	Endangered Species Act
F	FFCA	Federal Facilities Compliance Act
	FFACO	Federal Facilities Agreement and Consent Order
	FIDLER	field instrument for the detection of low-energy radiation
	FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
	FONSI	Finding of No Significant Impact

	FTU-1	Flight Test Unit 1
H	HAR HQ	Hawaii Administrative Rules headquarters
I	ICP-20 ICP-AES IDW IOC ISMS	Inductively Coupled Plasma-20 (stable metals) Inductively Coupled Plasma-Atomic Emission Spectrum Investigation Derived Waste Inorganic Compounds Integrated Safety Management System
J	JASSM JTA	Joint Air to Surface Stand-off Missile System Joint Test Assembly
K	KTF	Kauai Test Facility
L	LDR LLW	Land Disposal Restriction low-level waste
M	MBTA MDA MOA MEI MSDS MW	Migratory Bird Treaty Act minimum detectable activity Memorandum of Agreement maximally exposed individual Material Safety Data Sheet mixed waste
N	NAEG NAFB NCR NEDS NDEP NEPA NESHAP NFA NFEC NHPA NNSA NOS NPDES NPL N/R NSP NSPS NSO NTS NTTR NV	Nevada Applied Ecology Group Nellis Air Force Base (Range Complex) no code required Non Explosive Destruction Site Nevada Department of Environmental Protection National Environmental Policy Act National Emission Standards for Hazardous Air Pollutants No Further Action National Facilities Engineer Command National Historic Preservation Act National Nuclear Security Administration not otherwise specified National Pollutant Discharge Elimination System National Priorities List Not required Non-covered Source Permit New Source Performance Standard Nevada Site Office Nevada Test Site Nevada Test and Training Range Nevada
O	O&M OIG	Operations and Maintenance Office of Inspector General
P	PA PCB pH PMRF PMS PPE PSD	Preliminary Assessment polychlorinated biphenyl potential of Hydrogen Pacific Missile Range Facility portable monitoring station personal protective equipment Prevention of Significant Deterioration

Q	QA	quality assurance
R	RBIFF	Reentry Body Impact Fuze Flight
	R&D	research and development
	RCRA	Resource Conservation and Recovery Act
	ROD	Record of Decision
	RQ	Reportable Quantity
	RY	reporting year
S	SAIC	Science Applications International Corporation
	SARA	Superfund Amendments and Reauthorization Act
	SDI	Strategic Defense Initiative
	SDWA	Safe Drinking Water Act
	SHPO	State Historic Preservation Office
	SNL/KTF	Kauai Test Facility
	SNL/NM	Sandia National Laboratories, New Mexico
	SOC	Synthetic Organic Compounds
	SPCC	Spill Prevention, Control, and Countermeasures
	SSO	Sandia Site Office
	STARS	Strategic Targeting System
	SVOC	semi-volatile organic compound
T	TLD	thermoluminescent dosimeter
	TQ	threshold quantity
	TRPH	total recoverable petroleum hydrocarbon
	TRI	Toxic Release Inventory
	TSCA	Toxic Substances Control Act
	TSD	treatment, storage, and disposal (facility)
	TTR	Tonopah Test Range
U	UDP	underground discharge point
	USAF	U.S. Air Force
	USFS	U.S. Forest Service
	USGS	U.S. Geological Survey
	UST	underground storage tank
	UXO	unexploded ordnance
V	VOC	volatile organic compound

Units of Measure

°C	Celsius degree	m	meter
cm	centimeter	m ²	square meter
°F	Fahrenheit degree	m ³	cube meter
ft	feet	mg	milligram
g	gram	mi	mile
in.	inch	ppm	parts per million
km	kilometer	yd	yard
kg	kilogram	yr	year
lb	pound	Std Dev	standard deviation

Radioactivity Measurements

Ci	curie (unit of radioactivity)	pCi/g	picocurie per gram
mrem	millirem (unit of radiation dose)	rem	roentgen equivalent man
mrem/yr	millirem per year		(unit of radiation dose)

CONTENTS

mR/yr	milliroentgen per year	mSv	millisievert (unit of radiation dose)
pCi	picocurie	$\mu\text{g}/\text{m}^2$	microgram per square meter
$\mu\text{R}/\text{hr}$	microroentgen per hour		

Chemical Abbreviations

Am-241	americium-241	Cs-137	cesium-137
Pu-238	plutonium-238	Pu-239	plutonium-239
Pu-240	plutonium-240	U_{tot}	uranium, total

Approximate Conversion Factors for Selected SI (Metric) Units

Multiply SI (metric) unit	by	To obtain U.S. customary unit
Celsius ($^{\circ}\text{C}$)	$^{\circ}\text{F} = 9/5 ^{\circ}\text{C} + 32$	Fahrenheit ($^{\circ}\text{F}$)
centimeter (cm)	0.39	inch (in.)
cubic meter (m^3)	35	cubic feet (ft^3)
gram (g)	0.035	ounce (oz)
hectare (ha)	2.5	acre
kilogram (kg)	2.2	pound (lb)
kilometer (km)	0.62	mile (mi)
liter (L)	0.26	gallon (gal)
meter (m)	3.3	feet (ft)
milligram per liter (mg/L)	1	parts per million (ppm)
microgram per gram (mg/g)	1	parts per million (ppm)
square kilometer (km^2)	0.39	square mile (mi^2)

TTR & KTF EXECUTIVE SUMMARY

Tonopah Test Range
Environmental Programs:

Waste Management
Environmental Restoration
Project
Terrestrial Surveillance
Water Quality
Air Quality
National Environmental
Policy Act Activities

Kauai Test Facility
Environmental Programs
National Environmental
Policy Act Activities
Water Quality
Air Quality
Terrestrial Surveillance



Longleaf Phlox

Sandia National Laboratories (SNL) (a wholly-owned subsidiary of Lockheed Martin Corporation) at Tonopah Test Range (TTR) and Kauai Test Facility (KTF) are government-owned, contractor-operated facilities owned by the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA) and managed by the Sandia Site Office (SSO), in Albuquerque, New Mexico. This report was prepared in accordance with, and as required, by DOE Order 450.1, *Environmental Protection Program* (DOE 2005) and DOE Order 231.1A, *Environment, Safety, and Health Reporting* (DOE 2004b). This report summarizes data from environmental protection and monitoring programs at TTR and KTF for Calendar Year 2004. It also discusses Sandia Corporation's compliance with environmental statutes, regulations, and permit provisions and highlights other significant environmental programs and efforts at TTR and KTF. This report is a key component of Sandia Corporation and DOE's effort to keep the public informed about environmental conditions throughout the DOE/NNSA complex.

Tonopah Test Range

Sandia Corporation conducts operations at TTR in support of the DOE/NNSA's Weapons Ordnance Program. Sandia Corporation's activities involve research and development and testing of weapon components and delivery systems. Many of these activities require a remote test range with a long flight corridor for air drops and rocket launches. Other activities include explosive tests and gun firings.

Environmental Programs

The following environmental programs are in place at TTR:

- Waste management,
- Environmental Restoration (ER),
- Terrestrial surveillance,
- Water quality monitoring,
- Air quality compliance, and
- National Environmental Policy Act (NEPA).

Waste Management

Waste generated at TTR in 2004 included hazardous waste regulated by the Resource Conservation and Recovery Act (RCRA) and non-hazardous industrial and sanitary waste. All hazardous waste was shipped to permitted treatment, storage, and

disposal facilities. (Sandia Corporation does not handle waste generated by ER activities.)

ER Project

ER activities at TTR are conducted through the DOE/NNSA, Nevada Site Office (NSO). ER sites remaining at TTR include areas contaminated from target tests and detonations, non-impacted surface debris, and areas impacted by ordinance and depleted uranium.

Terrestrial Surveillance

Soil samples were collected from 14 off-site, eight perimeter, and 21 on-site locations in 2004. Soil is the only terrestrial medium sampled at TTR. Samples are collected to detect air-deposited pollutants or contaminants that may have transported and deposited as a result of surface water runoff.

Thermoluminescent dosimeter results (a measure of ambient gamma radiation) showed no distinguishable statistical difference between on-site and off-site locations in 2004. Non-radiological soil analyses were not performed in 2004. To date, there have been no terrestrial sample results that have indicated a significant level of concern (Priority-1) that would trigger actions at locations that are not already being addressed by the ER Project.

Water Quality

Wastewater monitoring results confirmed that all permit conditions set by the State of Nevada were met in 2004.

Water quality samples are routinely taken from Production Well 6, which supplies potable water for Sandia Corporation's Main Compound at TTR.

Air Quality

Radiological air emissions are regulated by National Emission Standards for Hazardous Air Pollutants. The only radionuclide sources at TTR are the three Clean Slate Sites, which are sources of diffused radionuclide emissions as a result of the re-suspension of contaminated soils. These sites are currently being addressed by DOE/NNSA/NSO under the ER Project. The calculated dose for the maximally exposed individual was 0.024 millirem/year (mrem/yr), which is approximately 400 times less than the 10 mrem/yr standard set by the U.S.

Environmental Protection Agency. Based on this value, an annual dose assessment is not required to be calculated for the TTR site.

TTR's Class II Air Quality Permit requires emission reports from significant non-radionuclide sources. At TTR, these sources include the screening plant and portable screen. In 2004, the total emissions to the state of Nevada were .002 ton/yr from the portable screen replacement.

NEPA

At TTR, NEPA compliance is coordinated between Sandia Corporation and DOE/NNSA/SSO. Compliance is also supported with the assistance of the Desert Research Institute, a branch of the University of Nevada System. A total of six NEPA reviews were processed during 2004. Two NEPA reviews were completed by SNL/NM. Four NEPA checklists were submitted to SSO for review. Three of these checklists were found to be categorically excluded, and one NEPA checklist is pending a decision at SSO.

Kauai Test Facility

KTF is operated by Sandia Corporation as a rocket preparation, launching, and tracking facility for DOE/NNSA, as well as in support of other U.S. Military agencies. SNL/KTF exists as a facility within the boundaries of the U.S. Department of Defense Pacific Missile Range Facility. SNL/KTF, located on the island of Kauai at the north end of the Pacific Missile Range Facility near Nohili Point, has been an active rocket-launching facility since 1962. There were no rockets launched from SNL/KTF in 2004.

The following environmental programs are in place at KTF:

- Air quality compliance,
- NEPA,
- Water quality monitoring, and
- Terrestrial surveillance (every five years).

Air Quality

As required by the EPA, the 2004 Annual Fee and Monitoring Report (air emissions) was submitted to the State of Hawaii at the end of February 2005 ([SNL 2005b](#)). In 2004, the total usage reported to the State of Hawaii was 4,736 gallons of diesel fuel. Sandia Corporation was in compliance with all air quality regulations in 2004.

NEPA

At KTF, NEPA compliance is coordinated between Sandia Corporation and DOE/NNSA/SSO. In 2004, Sandia National Laboratories/New Mexico (SNL/NM) completed one NEPA compliance review for proposed actions at SNL/KTF.

Water Quality

Septic tanks do not require permitting or sampling, but as a best management practice, Sandia Corporation periodically performs sampling. No contaminants were identified above the reporting limits.

Terrestrial Surveillance

Terrestrial surveillance is conducted every five years. No sampling occurred this year.

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chapter one

TTR INTRODUCTION

In This Chapter ...

TTR History and Operations
Site Description and Demographics
Regional Geology, Hydrology,
Climate, and Fauna
Clean Slate and Double Track Sites

Environmental Snapshot

The topography at TTR is characterized by a broad, flat, valley bordered by two north and south trending mountain ranges. Elevations within TTR range from 5,347 feet at the valley floor to 7,482 feet at Cactus Peak.



Wild Horses at TTR

Sandia Corporation (a subsidiary of Lockheed Martin Corporation through its contract with the U.S. Department of Energy [DOE]), National Nuclear Security Administration (NNSA), Sandia Site Office (SSO), operates the Tonopah Test Range (TTR) in Nevada.

Sandia Corporation's TTR is located on approximately 280 square miles (179,200 acres) within the boundaries of the Nevada Test and Training Range (NTTR) withdrawal and is used to support DOE/NNSA and U.S. Air Force (USAF) activities and missions. TTR is owned by the DOE/NNSA, and is managed by the SSO in Albuquerque, New Mexico. Westinghouse Government Service performs most environmental program functions on behalf of Sandia Corporation, including environmental media sampling, wastewater effluent and drinking water monitoring, spill response, and waste management operations. Westinghouse Government Service also supports TTR during tests by operating optics equipment, recovering test objects, and performing radiography.

This Annual Site Environmental Report (ASER) is prepared in accordance with the following DOE Orders that pertain to environmental protection and management:

- DOE Order 231.1A, *Environment, Safety, and Health Reporting* (DOE 2004b);
- DOE Order 231.1-2, *Occurrence Reporting and Processing of Operations Information* (DOE 2003);
- DOE Order 435.1, Chg 1, *Radioactive Waste Management* (DOE 2001);
- DOE Order 450.1, *Environmental Protection Program* (DOE 2005);
- DOE Order 5400.5, Chg 2, *Radiation Protection of the Public and the Environment* (DOE 1993); and
- SEN-22-90, *DOE Policy on Signatures of RCRA Permit Applications* (DOE 1990).

This ASER summarizes data from environmental protection and monitoring programs at TTR for 2004. The environmental programs summarized include waste management, air, water, terrestrial monitoring and surveillance, the Environmental Restoration (ER) Project, and the National Environmental Policy Act (NEPA). DOE Order 450.1 specifies the requirements for environmental monitoring conducted at and around the TTR site. The ASER

represents an important component of DOE and Sandia Corporation's effort to keep the public informed about environmental conditions at DOE/NNSA facilities.

Sandia Corporation's strategy for managing and implementing its Environment, Safety, and Health (ES&H) Program is described in the Integrated Safety Management System (ISMS). The ISMS program is structured around five safety management functions and provides the processes to assist line management in identifying and controlling hazards. Sandia Corporation is implementing an Environmental Management System (EMS) as an enhancement of the ISMS. The EMS is that part of the ISMS that addresses environmental consequences of SNL/NM's activities, products, and services. In 2004, SNL/NM continued to work to improve environmental management (EM) based on best management practices (BMPs), bench marking, and process improvements.

1.1 TTR HISTORY AND OPERATIONS

In 1940, President Roosevelt established the "Las Vegas Bombing and Gunnery Range" (now referred to as NTTR), which is part of the Nellis Air Force Base (NAFB) Complex. The NAFB Complex, located eight miles north of Las Vegas, Nevada, includes several auxiliary small arm ranges, and the NTTR—divided into a North Range and a South Range (Figure 1-1). The Nevada Test Site (NTS) is located between these two ranges. The entire NAFB Complex is comprised of approximately three million acres. TTR is located 32 miles (mi) southeast of Tonopah, Nevada.

TTR Site Characteristics

The topography at TTR is characterized by a broad, flat, valley bordered by two north and south trending mountain ranges: the Cactus Range to the west (occurring mostly within the boundaries of TTR) and the Kawich Range to the east. Cactus Flat is the valley floor where the main operational area of TTR is located. An area of low hills outcrops in the south. Elevations within TTR range from 5,347 feet at the valley floor to 7,482 feet at Cactus Peak. The elevation within the town of Tonopah is 6,030 feet.

TTR Site Selection

TTR was selected as a bombing range after similar facilities at the Salton Sea Test Base in California, as well as Yucca Flat on the NTS, became inadequate. By the mid-1950s, the atmosphere at the Salton Sea Test Base became permeated with haze, which limited visibility and hampered photography. Nevada's Yucca Flat site also became inadequate

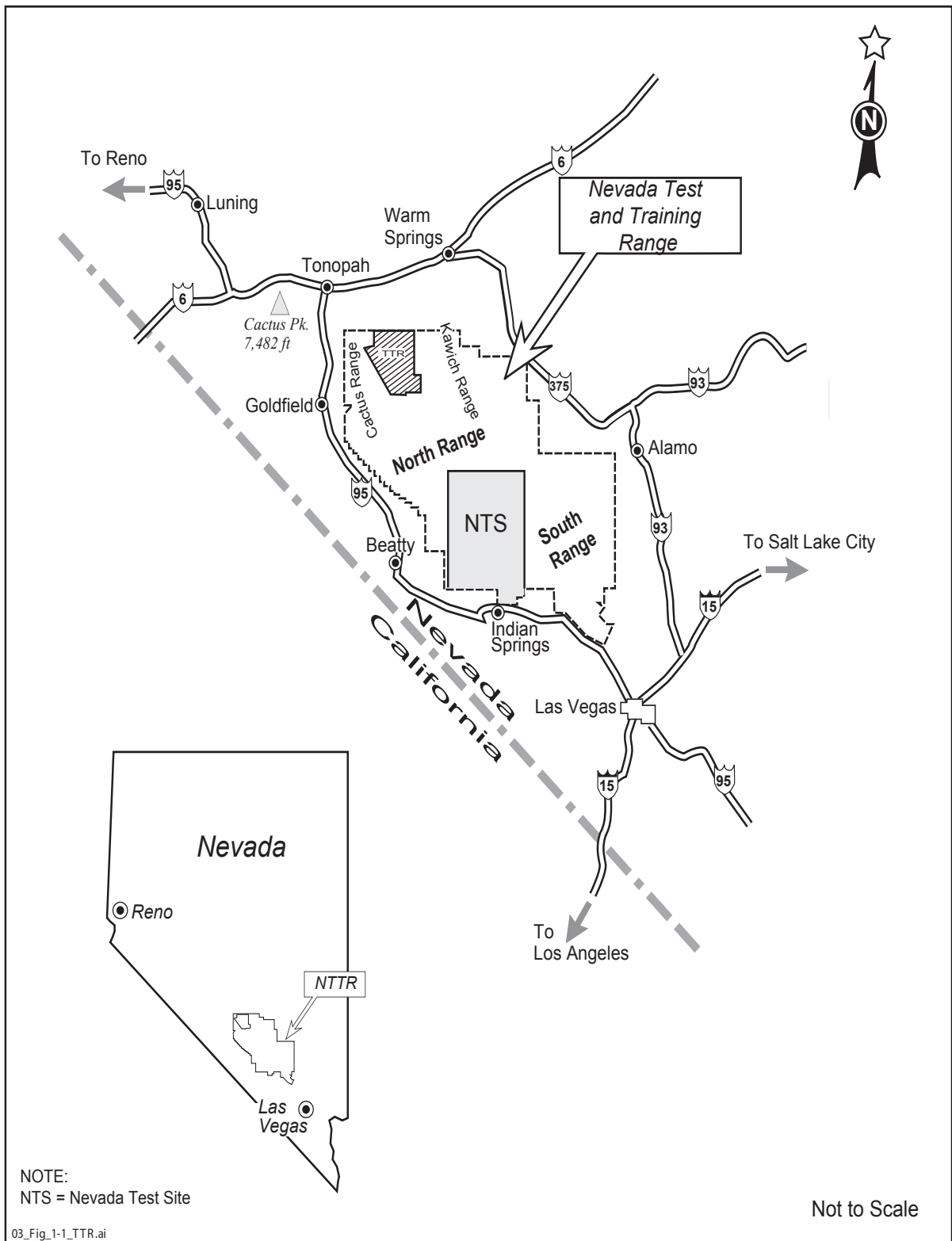


FIGURE 1-1. Location of the Tonopah Test Range (TTR), Within the Boundaries of the Nevada Test and Training Range (NTTR), Nevada.

due to the increasing emphasis on low-altitude approaches and deliveries that required flat terrain and a long approach corridor. The TTR site was located in the northwest corner of the then Las Vegas Bombing and Gunnery Range. The site, which was approximately seven times the size of the Salton Sea Test Base, was well suited because it had immense areas of flat terrain needed for the increasing use of rockets and low-altitude, high-speed aircraft operations. The area was withdrawn in 1956 and TTR became operational in 1957 to operate and test new weapon systems. In the years following World War II, facilities that were built at TTR were originally designed and equipped to gather data on aircraft delivered inert test vehicles under U.S. Atomic Energy Commission (AEC) cognizance (now DOE). Over the years, the facilities and capabilities at TTR were expanded to accommodate tests related to the DOE/NNSA's Weapons Ordnance Program.

Operations Control Center

The Main Compound in Area 3 is the heart of the test range activities. The Operations Control Center controls and coordinates all test functions and affords a 360-degree view of the site. During test operations, the test director, range safety officer, test project engineer, camera controller, and range communicator operate the consoles in the Operations Control Center to control and coordinate all test functions.

TTR Activities

Principal DOE activities at TTR include stockpile reliability testing; research and development (R&D) testing support of structural development; arming, fusing and firing systems testing; and testing nuclear weapon delivery systems. No nuclear devices are tested at TTR.

TTR is instrumented with a wide array of signal tracking equipment including video, high-speed cameras, radar tracking devices used to characterize ballistics, aerodynamics, and parachute performance on artillery shells, bomb drops, missiles, and rockets.

In recent years, specific test activities at TTR have consisted of the following:

- Air drops (trajectory studies of simulated weapons);
- Gun firings;
- Ground-launched rockets (study of aeroballistics and material properties);
- Air-launched rockets (deployed from aircraft);

- Explosive testing (e.g., shipping and storage containers);
- Static rocket tests (related to the Trident Submarine Program); and
- Ground penetrator tests.

These activities require a remote range for both public safety and to maintain national security. The majority of test activities at TTR occur within Cactus Flat, a valley with almost no topographical relief flanked by mountains and hills.

Site Responsibility

On October 1, 1997, a Memorandum of Agreement (MOA) was signed between DOE/SSO and the DOE/ Nevada Site Office (NSO) in regards to operational test activities at TTR (DOE 1994). It was determined that DOE/SSO is responsible for the oversight of TTR; however, DOE/NSO will continue with the oversight of ER activities at TTR. Environmental program management, as discussed in this ASER, is a joint effort between Sandia Corporation's TTR and Sandia National Laboratories, NM (SNL/NM) employees and contractors with oversight from DOE/SSO. In April 2002, a Land Use Permit was signed between the USAF and NNSA entitled, "Department of the Air Force Permit to the National Nuclear Security Administration To Use Property Located On The Nevada Test and Training Range, Nevada." The current size of TTR is approximately 280 square miles (179,200 acres). Prior to the April 2002 lease agreement, the footprint was 335,655 acres.

1.2 SITE DESCRIPTION AND DEMOGRAPHICS

TTR is located within the NTTR at the northern boundary. The area north of the TTR boundary is sparsely populated public lands administered by both the U.S. Bureau of Land Management (BLM) and the U.S. Forest Service (USFS). The land is currently used to graze cattle. There is a substantial irrigated farming operation to the north of the range as well. To the east of TTR, and within the NTTR, is the Nevada Wild Horse Range, which is also administered by the BLM.

The nearest residents are located in the town of Goldfield (population 659), approximately 22 miles west of the site boundary. The town of Tonopah (population 4,400) is approximately 30 miles northwest of the site ([DOC 2005](#)). Las Vegas, Nevada is 140 miles from TTR. The total population within a 50-miles radius around TTR is approximately 7,000, which includes the potential population at TTR if all housing units at the site were occupied.

1.3 REGIONAL GEOLOGY, HYDROLOGY, CLIMATE, AND FAUNA

Geology

The regional area around TTR is located in the western part of the Basin and Range geophysical province. This area is marked by horst and graben topography, a system of mountains and down-dropped fault valleys formed through regional extension. TTR lies northeast of the Walker Lane, a zone of transcurrent faulting and shear, and the Las Vegas Valley shear zone to the southeast (Sinnock 1982).

The Cactus Range to the west of TTR is the remnants of a major volcanic center consisting of relatively young (six million-year-old) folded and faulted tertiary volcanics. This range is one of at least five northwest trending, raised structural blocks that lie along the Las Vegas Valley-Walker Lane lineaments (ERDA 1975).

Surface Water

Drainage patterns within and near TTR are intermittent (ephemeral stream channels) and end in closed basins. Ephemeral streams occasionally carry spring runoff to the center of Cactus Flat where there is a string of north-south trending dry lakebeds; however, due to the high rate of evaporation, little is recharged to the groundwater (DRI 1991).

There are several small springs within the Cactus and Kawich Ranges. Three springs occur within TTR boundaries: Cactus, Antelope, and Silverbow Springs. Water from these springs does not travel more than several tens of meters dissipating rapidly through evaporation and infiltration. The effect on the landscape is purely local.

Groundwater

TTR obtains its water from local wells. The U.S. Geological Survey (USGS) has recorded groundwater depths from 21 to 454 feet at the site. Groundwater is encountered at the Antelope Mine well in the Cactus Range at 21 feet and at the EH2 well near the TTR Airport at 454 feet. The depth to groundwater at the Area 9 well located at the north end of the site is approximately 131 feet. South of the Area 9 well, groundwater is encountered at 361 to 394 feet in Area 3. The static water level at the main water supply well (Well 6) is approximately 350 feet.

Climate

The climate at TTR is typical of high desert, mid-latitude locations, with large diurnal and seasonal changes in temperature, and little total rainfall.

Temperature extremes on the test range can vary from a high near 40 °C (104 °F) in the summer and approach -30 °C (-22 °F) in the winter. July and August are the hottest months with daily highs ranging from 32 to 37 °C (90s °F) and temperatures between 10 and 15 °C (50s °F) at night. January conditions vary from highs 5 to 10°C (40s °F) to lows -7 to -11°C (teens °F). An eight-year climatology developed from data taken in the 1960s identifies a record high of 38.8°C (102 °F) and a record low of -31°C (-24 °F) (Schaeffer 1970).

Rainfall, though sparse, is dependent on elevation. Annual average rainfall on the desert floor is 4 inches with as much as 12 inches falling in the mountains (USAF 1999).

Winds are generally from the northwest in the winter and early spring, switching to southerly directions during the summer. The mountain/valley system channels the wind so that the wind seldom blows from the east or southwest directions. Dust storms are common in the spring, when monthly average wind speeds reach 6.7 m/s (15 miles an hour). During the spring and fall months, a diurnal cycle to the wind may be seen with northwest drainage winds for a time, and southerly winds by afternoon.

Vegetation

Temperature extremes and arid conditions of the high desert limit vegetation coverage. Sparse vegetation that occurs in Cactus Flat is predominantly range grasses and low shrubs typical of the Great Basin Desert flora (ERDA 1975; EG&G 1979).

Vegetation is divided into two basic types at the site by elevation—salt desert shrub in the low areas and northern desert shrub in the higher elevations (USAF 1999, DRI 1991). Salt desert shrub is characteristic of poorly drained soils and is common along dry lakebeds. Specific plants in this group include shadscale (*Atriplex confertifolia*), Russian thistle (*Salsola kali*), and sagebrush (*Artemisia tridentata*). Northern desert shrub, found in the Cactus Range, includes a variety of sagebrush, rabbitbrush (*Chrysothamnus nauseosus*), squirrel tail (*Elymus longifolius*), juniper (*Juniperus*), and Nevada bluegrass (*Poa nevadensis*). Joshua tree (*Yucca brevifolia*) and juniper grow in the transition zone at the base of the mountains.

Wildlife

The Nevada Wild Horse Range and other wild horse land-use areas compose a significant portion of the North Range with herds common in Cactus and Gold Flats, Kawich Valley, Goldfield Hills, and the Stonewall Mountains. Hundreds of wild horses (*Equus caballus*) graze freely throughout

TTR and activities on-site have had little affect on the horse population or their grazing habits. The BLM routinely rounds up a portion of the herds for dispersal through the Horse Adoption Program.

Other mammals common to the area include pronghorn (*Antilocapra americana*), mule deer (*Odocoileus hemionus*), kit fox (*Vulpes macrotis*), bobcat (*Zynx rufus*), coyote (*Canis latrans*), and gray fox (*Urocyon cinereoargenteus*). To a lesser extent, bighorn sheep (*Ovis canadensis*), mountain lion (*Felis concolor*), and burros (*Equus asinus*) are also present (USAF 1999, DRI 1991).

In general, the NTTR land withdrawal has provided a positive effect on local plant and animal life. Since much of the withdrawal area is undisturbed by human activity, large habitat areas are protected from the affects of public use.

1.4 CLEAN SLATE AND DOUBLE TRACK SITES

In May and June 1963, Project Roller Coaster included a series of four nuclear weapons destruction tests that resulted in plutonium dispersal in the surrounding soils. Three of these tests were conducted within the boundaries of TTR; the fourth was conducted on the NTTR just west of TTR. The three Project Roller Coaster test sites at TTR are referred to as Clean Slates 1, 2, and 3 (Figure 1-2).

The fourth test site at NTTR is referred to as Double Tracks. In 1996, Double Tracks was closed after soil contamination was remediated to a level of less than or equal to 200 picocurie per gram (pCi/g) of transuranics.

Table 1-1 summarizes test information related to the four Project Roller Coaster sites. DOE/NNSA/NSO is responsible for the remediation of these and all other Environmental Restoration (ER) sites (see Chapter 3) at TTR. Sandia Corporation will continue to be responsible for environmental compliance at these sites.

The initial cleanup of each Clean Slate site was conducted shortly after each test. Test-related debris was bladed into a hole at test ground zero and backfilled. An initial fence was built around each test area where the soil contamination was set at approximately 1,000 $\mu\text{g}/\text{m}^2$ of plutonium. The soil survey was conducted on 61-m grids with a hand-held survey meter or field instrument for the detection of low-energy radiation (FIDLER). In 1973, additional outer fences were set at 40 pCi/g of plutonium in soil also using the hand-held meter method. Soil sampling is conducted periodically at these sites and the areas are visually inspected twice a year to determine whether any fence repairs are required. Any horses that may wander inside the fenced areas are promptly relocated.

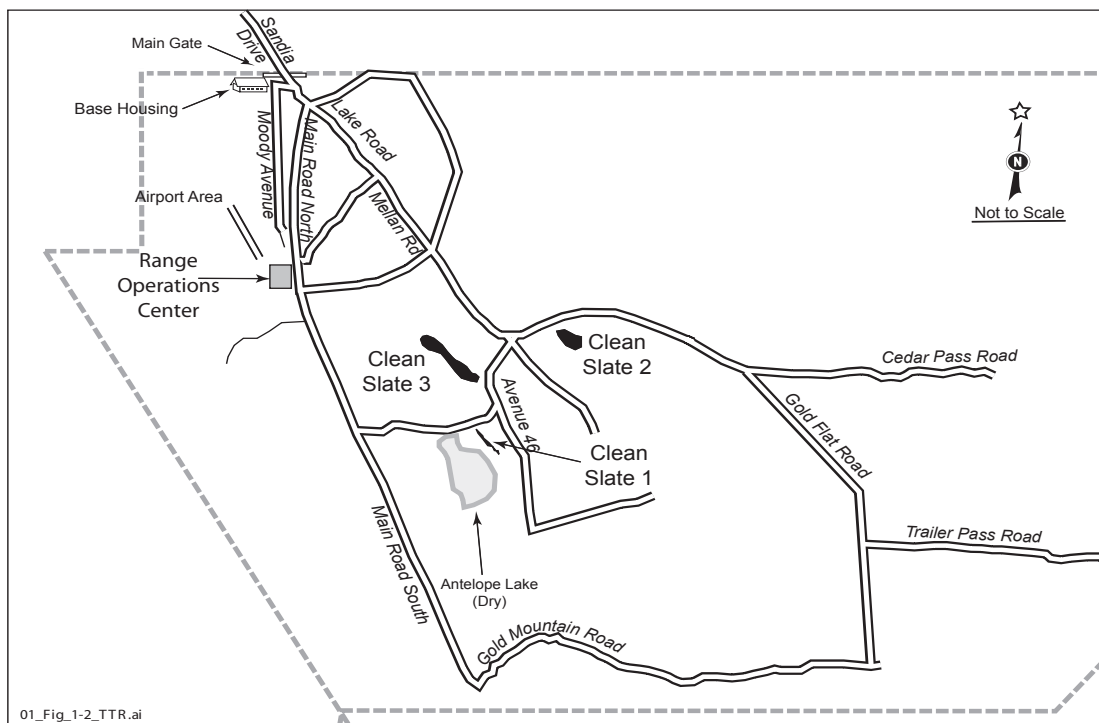


FIGURE 1-2. Location of Facilities Operated by SNL/NSO at TTR

TABLE 1-1. Project Roller Coaster Test Information

Test Name	Date of Test	Location	Status
Clean Slate 1	May 25, 1963	TTR	Closed
Clean Slate 2	May 31, 1963	TTR	Remediation phase
Clean Slate 3	June 9, 1963	TTR	Remediation has not started
Double Tracks	May 15, 1963	NTTR, North Range (west of TTR)	Closed

NOTE: TTR = Tonopah Test Range

NTTR = Nevada Test and Training Range

Source : Sampling and Analysis Plan for Clean Slate 1, September 1996 (IT 1996)

In 1977, an aerial radiological survey was performed by EG&G, Inc. for the Nevada Applied Ecology Group (NAEG) (EG&G 1995). The aerial radiological surveys were undertaken to supplement the FIDLER and previous soil sample measurements of transuranics. The objective was to determine the extent of surficial distribution of plutonium and other transuranic elements dispersed during the Project Roller Coaster tests. Radiation isopleths showing soil activity due to americium-241 (Am-241), plutonium-239 (Pu-239), and plutonium-240 (Pu-240) were drawn for each area. The cumulative area of the diffuse sources, as determined by the aerial radiological survey, is 20 million m² (approximately 4900 acres). The results of the survey found transuranic contamination outside the fenced area in the downwind direction (EG&G 1995).

Air Monitoring at ER sites

Remediation activities were conducted at Clean Slate 1 in 1997. The Desert Research Institute (DRI) collected air monitoring data from several locations in the vicinity of Clean Slate 1 before, during, and after remediation activities. Although these data have been validated, they have only as of yet been presented to DOE/NSO in the form of a draft report (DRI 1997). Bechtel Nevada has two air monitoring stations available for use at TTR. DOE/NSO suspended air monitoring in April 2000 and will not resume until active remediation efforts at the Clean Slate sites begin again. Clean Slates 1, 2, 3, and Double Tracks and a number of other sites at the Nevada Test Site are Corrective Action Units (CAUs) in the Soils Project, which has been suspended because of cleanup level issues.

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chapter two

TTR COMPLIANCE SUMMARY

In This Chapter ...

Compliance Status with
Federal Regulations
2004 Audits
2004 Issues and Actions for
TTR
Environmental Permits
Occurrence Reporting

Environmental Snapshot

Environmental compliance permits for TTR include those for potable water supply, Resource Conservation and Recovery Act (RCRA), and specific air emission units, such as screening plants.



Antelope at TTR

Sandia Corporation is responsible for Environment, Safety, and Health (ES&H) compliance with federal environmental statutes, regulations, Executive Orders (EOs), and U.S. Department of Energy (DOE) Orders applicable to Tonopah Test Range (TTR).

This chapter discusses Sandia Corporation's responsibility and the status of ES&H compliance. Environmental audit summaries, occurrence reporting, and environmental permit status for 2004 are also presented in this chapter.

The State of Nevada administers most environmental regulations applicable to TTR. Specific state regulations listed in Chapter 6 include regulations governing air quality, solid and hazardous waste management, wildlife, water quality, and radiation control. Radionuclide air emission regulations are administered directly by the U.S. Environmental Protection Agency (EPA).

2.1 COMPLIANCE STATUS WITH FEDERAL REGULATIONS

This section summarizes DOE and Sandia Corporation's compliance status with major environmental regulations, statutes, EOs, and DOE Orders that pertain to the environment.

Major federal laws applicable to environmental compliance at TTR are presented on [page 2-3](#) (see shaded box).

2.1.1 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

CERCLA defines assessment activities and reporting requirements for inactive waste sites at federal facilities. As required by CERCLA, a Preliminary Assessment (PA) was submitted in 1988 for all facilities listed on the federal agency hazardous waste compliance docket. Sites with significant contamination were put on the National Priorities List (NPL) for cleanup ([EPA 2005](#)). There are no NPL or "Superfund" sites located at TTR.

Additional CERCLA requirements are given in the Superfund Amendments and Reauthorization Act (SARA) Title III for reportable quantity (RQ) releases and chemical inventory reporting. Sandia

Corporation at TTR was in full compliance with CERCLA, SARA, and RQ in 2004. [Table 2-1](#) lists SARA Title III reporting requirements.

2.1.2 Emergency Planning and Community Right-to-Know Act (EPCRA)

SARA Title III (also known as EPCRA) requires the submittal of a Toxic Release Inventory (TRI) report for chemical releases over a given threshold quantity (TQ). The release reporting limit for lead is 100 lbs. The TTR Firing Range released approximately 1,790 lbs of non-recovered lead in 2004. This information will be reported in the Reporting Year (RY) 2004 TRI Report.

2.1.3 Resource Conservation and Recovery Act (RCRA)

Under the RCRA Hazardous Waste Permit Program (40 CFR 270), TTR is permitted as a "small quantity generator." Under this designation, hazardous waste can only be stored on-site for 180 days before it must be shipped off-site for treatment and disposal at an EPA-permitted facility. At TTR, hazardous waste shipments are scheduled to occur at least two to three times a year.

Sanitary solid waste, which is also regulated under RCRA, is disposed of at landfills on-site. There is one Class II sanitary landfill in operation at TTR operated by the U.S. Air Force (USAF) Operations and Maintenance contractor. The landfill is used cooperatively by all organizations at TTR.

Underground Storage Tanks (USTs) and Aboveground Storage Tanks (ASTs) – RCRA, Subchapter I (40 CFR 280) sets forth requirements for USTs that contain hazardous materials or petroleum products. The last five USTs (two diesel tanks and two gasoline tanks were removed from Area 3 at the site of a former gas station and one diesel tank was removed from Area 9 that had supplied generator fuel) were removed in August 1995. There are no ASTs requiring registration with the State of Nevada at TTR.

2.1.4 Federal Facility Compliance Act (FFCA)

The FFCA amendments to RCRA specifically address Land Disposal Restriction (LDR) requirements for the treatment of mixed waste (MW) at federal

Major Environmental Regulations & Statutes Applicable to TTR

Clean Air Act (CAA) and CAA Amendments (CAAA)

Provides standards to protect the nation's air quality http://www.epa.gov/oar/oaq_caa.html

Clean Water Act (CWA)

Provides general water quality standards to protect the nation's water sources and byways
<http://www.epa.gov/region5/watercwa.htm>

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances <http://www.epa.gov/region5/defs/html/cercla.htm>

Cultural resources acts

Includes various acts that protect archeological, historical, religious sites, and resources
http://water.usgs.gov/eap/env_guide/cultural.html

Endangered Species Act (ESA)

Provides special protection status for federally-listed endangered or threatened species
<http://www.epa.gov/region5/defs/html/esa.htm>

Executive Orders (EOs)

Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and greening the government through leadership in environmental management
http://www.archives.gov/federal_register/executive_orders/disposition_tables.html

Federal Facility Compliance Act (FFCA)

Directs federal agencies regarding environmental compliance <http://tis.eh.doe.gov/oepa/laws/ffca.html>

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Controls the distribution and use of various pesticides <http://www.epa.gov/region5/defs/html/fifra.htm>

Migratory Bird Treaty Act (MBTA) of 1918

Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests <http://tis.eh.doe.gov/oepa/laws/mbta.html>

National Emission Standards for Hazardous Air Pollutants (NESHAP)

Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA
<http://www.epa.gov/radiation/neshaps/>

National Environmental Policy Act (NEPA)

Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making <http://tis.eh.doe.gov/NEPA/>

Resource Conservation and Recovery Act (RCRA)

Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (USTs) <http://www.epa.gov/region5/defs/html/rcra.htm>

Safe Drinking Water Act (SDWA)

Provides specific standards used for drinking water sources <http://www.epa.gov/safewater/sdwa/sdwa.html>

Superfund Amendments and Reauthorization Act (SARA)

SARA, Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community
<http://www.epa.gov/region5/defs/html/sara.htm>

Toxic Substance Control Act (TSCA)

Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs) <http://www.epa.gov/compliance/civil/tsc/index.html>

TABLE 2-1. 2004 SARA Title III (or EPCRA) Reporting Requirements Applicable to TTR

Section	SARA Title III Section Title	Requires Reporting?		Description
		Yes	No	
302–303	Emergency Planning	X		Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/ NNSA/SSO, which distributes it to the required entities.
304	Emergency Notification		X	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2004.
311-312	Hazardous Chemical Storage Reporting Requirements	X		There are two “Community Right-to-Know” reporting requirements: (a) SNL/NM completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) TTR provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA’s alternative MSDS reporting, which is detailed in 40 CFR Part 370.21.
313	Toxic Chemical Release Forms	X		EPCRA, Section 313, requires that facilities that use toxic chemicals listed in SARA Title III over a threshold value must submit a TRI report. For RY 2004, a report was submitted for lead.

NOTE: MSDS = Material Safety Data Sheets (gives relevant chemical information)

□

TRI = Toxic Release Inventory

SSO = Sandia Site Office

NNSA = National Nuclear Security Administration

CIS = Chemical Inventory System

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

EPCRA = Emergency Planning and Community Right-to-Know Act

SARA = Superfund Amendments and Reauthorization Act

DOE = U.S. Department of Energy

EPA = U.S. Environmental Protection Agency

RY = reporting year

lbs = pounds

facilities. Since TTR does not generate MW and currently has no MW stored on-site, this statute is not applicable to Sandia Corporation’s operations at TTR.

2.1.5 Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990

CAA and CAAA of 1990 requirements are regulated by the State of Nevada air quality regulations. Air emissions from non-radionuclide sources, such as a screening plant and a portable screen, are permitted under a Class II Air Quality Permit. Sandia Corporation tracks emissions and pays a fee to the State of Nevada based on the total standard tons emitted. Sandia Corporation met all air quality permit conditions in 2004.

National Emission Standards for Hazardous Air Pollutants (NESHAP) Compliance

The EPA retains compliance authority for all radionuclide air releases, which are regulated by NESHAP and implemented under 40 CFR 61,

Subpart H. The Clean Slate sites, as discussed in Chapter 1, have been the only source of radionuclide air emissions at TTR. Continuous air monitoring was conducted from February 22, 1996 to February 25, 1997 (SNL 1997). The TTR Airport was determined to be the location of the maximally exposed individual (MEI). The result of 0.024 millirems per year (mrem/yr) was below the threshold of 0.1 mrem/yr for which continuous air monitoring would be required and approximately 400 times less than the EPA standard of 10 mrem/yr. The NESHAP Annual Report for 2004 and Chapter 4 of this report discuss these monitoring results (SNL 2005).

2.1.6 Clean Water Act (CWA)

Wastewater effluents and potable water supplies are regulated under the CWA and State of Nevada water pollution and sanitary waste systems regulations. The State of Nevada, Bureau of Health Protection Services and the Nevada Department of Environmental Protection (NDEP) administer

regulations relevant to wastewater discharges. At TTR, wastewater is discharged to the sewer system connected to the USAF sewage lagoon and to six septic tank systems.

There were no excursions or other permit violations in 2004 with respect to wastewater discharges.

Storm Water

The issuance of a National Pollutant Discharge Elimination System (NPDES) storm water permit is generally based on whether or not storm water runoff is discharged to “Waters of the U.S.” This definition includes rivers, lakes, streams, and swamps, as well as channels and arroyos that lead to waters that are currently used, have been used in the past, or may be susceptible for use in interstate or foreign commerce. The TTR site is primarily a closed basin with runoff evaporating or infiltrating to the ground. The USAF has permitted its airfield and Area 10 for storm water runoff and have cognizance over all storm water issues at the site. Currently, Sandia Corporation does not conduct any activities at TTR that require storm water permitting or monitoring.

2.1.7 Safe Drinking Water Act (SDWA)

Sandia Corporation meets standards for drinking water as defined in the SDWA and State of Nevada public water supply and public water systems regulations. Well 6 provides all drinking water for Sandia Corporation’s operations at TTR and is operated under a permit issued by the State of Nevada. [Chapter 4](#) of this report discusses monitoring activities.

2.1.8 Toxic Substances Control Act (TSCA)

Compliance with TSCA at TTR primarily concerns the management of asbestos and polychlorinated biphenyls (PCBs). As defined by the TSCA, any material with greater than or equal to 500 parts per million (ppm) is considered a “PCB”; materials with greater than or equal to 50 ppm, but less than 500 ppm are considered as “PCB-contaminated.” In 1993, sampling was performed on TTR transformers to determine if PCBs were present in the soil ([IT 1993](#)). All samples contained less than 50 ppm of PCBs.

Decontamination and demolition (D&D) operations conducted at TTR during 2004 generated 8 yd³ of asbestos containing material (ACM) waste.

2.1.9 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Chemical pesticides used at TTR include herbicides, rodenticides, and insecticides, as required. All chemicals used are EPA-approved and applied in accordance with applicable label guidelines and regulations. Sandia Corporation retains records of the quantities and types of pesticides that are used as well as Material Safety Data Sheets (MSDSs) for each pesticide. There were no violations of the FIFRA in 2004.

2.1.10 National Environmental Policy Act (NEPA)

NEPA requires federal agencies and private entities that perform federally-sponsored projects to include environmental aspects in early project planning and decision-making. A major intent of the law is to ensure that federal agencies are aware of the potential environmental impacts associated with their operations and include this information in early project planning and decision making. NEPA mandates that an agency’s decision process be open for public review. Additionally, if a proposed action is determined to have environmentally “significant” impacts, the agency must prepare an environmental assessment (EA) or an environmental impact statement (EIS) before an irretrievable commitment of resources or funding occurs. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to select the proposed action alternative with the least environmental impacts.

NEPA activities are discussed in [Section 3.4](#).

2.1.11 Endangered Species Act (ESA)

The ESA applies to both private individuals and federal agencies. Federal agencies must ensure that any action authorized, funded, or carried out by them will not jeopardize the continued existence of a threatened or endangered species, or result in adverse modifications of its habitat. The ESA is addressed under the NEPA Program and Ecology Program. If potentially significant impacts to sensitive species or habitats are found as a result of the proposed action, an EA or an EIS must be prepared.

Table 2-2 lists all federal and state protected species occurring within Nye County; therefore, having the potential to occur at TTR.

2.1.12 Migratory Bird Treaty Act (MBTA)

The MBTA of 1918 implemented the 1916 Convention for the protection of migratory birds. The original statute implemented the agreement between the United States (U.S.) and Great Britain (for Canada) and later amendments implemented treaties between the U.S. and Mexico, the U.S. and Japan, and the U.S. and Russia. The MBTA prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests. Federal institutions are not exempt from the MBTA. New guidance is being developed by the U.S. Fish and Wildlife Service to assist federal institutions in interpreting this Act. At Sandia Corporation's TTR, the MBTA is coordinated with NEPA compliance reviews and the Ecology Program.

2.1.13 Cultural Resources Acts

Federal cultural resources management responsibilities are applicable to activities at TTR. These include but are not limited to compliance with the following laws and their associated regulations:

- National Historic Preservation Act (NHPA)
- Archaeological Resources Protection Act (ARPA)
- American Indian Religious Freedom Act (AIRFA)

DOE/National Nuclear Security Administration (NNSA) Sandia Site Office (SSO) is responsible for determining the level of applicability of cultural resources requirements. In 2004, Sandia Corporation's operations did not impact any known cultural resources sites at TTR.

Historical Building Assessment

In 2004, DOE/NNSA/SSO initiated a consultation with the Nevada State Historic Preservation Office (SHPO) on 212 buildings at TTR. The SHPO did not concur with the DOE determination of eligibility for the 212 buildings. At the SHPO's request, Sandia Corporation contracted with an architectural historian to evaluate the TTR buildings under National Register Criterion C. A revised report on

the buildings at TTR will be submitted to the Nevada SHPO during 2005.

A consultation with the Nevada SHPO for rebuilding the TTR power system was initiated in 2004. A cultural resource inventory report was completed following an intensive archeological and historic inventory of the proposed project area. No historic properties were found within the proposed project area. As a result, in January 2005, the SHPO concurred with the DOE/NNSA/SSO determination that no historic properties would be affected by the proposed undertaking.

2.1.14 Environmental Compliance EOs

EO 11988, *Floodplain Management*, as amended, and EO 11990, *Protection of Wetlands*, as amended, require evaluation of the potential effects of actions taken in these environmentally sensitive areas. There are no floodplains or significant wetlands at TTR; however, some very limited wetlands exist in the vicinity of several springs. These provide an important source of drinking water for wildlife in the area. Sandia Corporation complies with all applicable mandates stated in these EOs.

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended, requires that to the greatest extent practicable and permitted by law, and consistent with the principles set forth in the Report on the National Performance Review (Gore 1993), each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States and its territories and possessions. Sandia Corporation must include in the assessment of its operations any disproportionate impacts on minority or low-income populations within the area of influence of the Laboratories' operations.

EO 13148, *Greening the Government Through Leadership in Environmental Management*, requires federal agencies to ensure that "all necessary actions are taken to integrate environmental accountability into agency day-to-day decision-making and long-term planning processes, across all agency missions, activities, and functions." Among the primary

TABLE 2-2. Protected Species Potentially Occurring in Nye County, Nevada

Common Name	Scientific Name	Federal Status	State of Nevada Status
PLANTS			
Sodaville Milkvetch	<i>Astragalus lentiginosus</i> var. <i>sesquimetralis</i>	---	State Protected
Halfing Milkvetch	<i>Astragalus mohavensis</i> var. <i>hemigyus</i>	SOC	State Protected
Ash Meadows Milkvetch	<i>Astragalus phoenix</i>	Threatened	State Protected
Armored Hedgehog Cactus	<i>Echinocereus engelmannii</i> var. <i>armatus</i>	---	State Protected
Ash Meadows Sunray	<i>Enceliopsis nudicaulis</i> var. <i>corrugata</i>	Threatened	State Protected
Mojave Barrel Cactus	<i>Ferocactus cylindraceus</i> var. <i>lecontei</i>	---	State Protected
Sunnyside Green Gentian	<i>Frasera gypsicola</i>	SOC	State Protected
Ash Meadows Gumplant	<i>Grindelia fraxinopratisensis</i>	Threatened	State Protected
Ash Meadows Mousetails	<i>Ivesia kingii</i> var. <i>eremica</i>	Threatened	State Protected
Ash Meadows Blazingstar	<i>Mentzelia leucophylla</i>	Threatened	State Protected
Amargosa Niterwort	<i>Nitrophila mohavensis</i>	Endangered	State Protected
Sand Cholla	<i>Opuntia pulchella</i>	---	State Protected
Williams Combleaf	<i>Polycetium williamsiae</i>	---	State Protected
Blaine Pincushion	<i>Sclerocactus blainei</i>	SOC	State Protected
Tonopah Pincushion	<i>Sclerocactus nyensis</i>	---	State Protected
Hermit Cactus	<i>Sclerocactus polyancistrus</i>	---	State Protected
INSECTS			
Ash Meadows Naucorid	<i>Ambrysus amargosus</i>	Threatened	---
FISH			
White River Desert Sucker	<i>Catostomus clarki intermedius</i>	SOC	State Protected
Moorman White River Springfish	<i>Crenichthys baileyi thermophilus</i>	SOC	State Protected
Railroad Valley Springfish	<i>Crenichthys nevadae</i>	Threatened	State Protected
Devils Hole Pupfish	<i>Cyprinodon diabolis</i>	Endangered	State Protected
Ash Meadows Amargosa Pupfish	<i>Cyprinodon nevadensis mionectes</i>	Endangered	State Protected
Warm Springs Amargosa Pupfish	<i>Cyprinodon nevadensis pectoralis</i>	Endangered	State Protected
Pahrump Poolfish	<i>Empetrichthys latos latos</i>	Endangered	State Protected
White River Spinedace	<i>Lepidomeda albivallis</i>	Endangered	State Protected
Moapa Dace	<i>Moapa coriacea</i>	Endangered	State Protected
Lahontan Cutthroat Trout	<i>Oncorhynchus clarki henshawi</i>	Threatened	State Protected
Big Smoky Valley Speckled Dace	<i>Rhinichthys osculus lariversi</i>	---	State Protected
Ash Meadows Speckled Dace	<i>Rhinichthys osculus nevadensis</i>	Endangered	State Protected
Big Smokey Valley Tui Chub	<i>Siphateles bicolor</i> ssp. 8	SOC	State Protected
Hot Creek Valley Tui Chub	<i>Siphateles bicolor</i> ssp. 5	SOC	State Protected
Little Fish Lake Valley Tui Chub	<i>Siphateles bicolor</i> ssp. 4	---	State Protected
Railroad Valley Tui Chub	<i>Siphateles bicolor</i> ssp. 7	SOC	State Protected
AMPHIBIANS			
Amargosa Toad	<i>Bufo nelsoni</i>	---	State Protected
Columbia Spotted Frog	<i>Rana luteiventris</i> pop 3	Candidate	---
REPTILES			
Banded Gila Monster	<i>Heloderma suspectum cinctum</i>	SOC	State Protected
Desert Tortoise (Mojave Desert pop.)	<i>Gopherus agassizii</i>	Threatened	State Protected
MAMMALS			
Spotted Bat	<i>Euderma maculatum</i>	SOC	State Protected
Pygmy Rabbit	<i>Brachylagus idahoensis</i>	SOC	State Protected
American Pika	<i>Ochotona princeps</i>	---	State Protected
Kit Fox	<i>Vulpes macrotis</i>	---	State Protected
BIRDS			
Northern Goshawk	<i>Accipiter gentilis</i>	SOC	State Protected
Golden Eagle	<i>Aquila chrysaetos</i>	---	State Protected
Long-eared Owl	<i>Asio otus</i>	---	State Protected
Western Burrowing Owl	<i>Athene cunicularia hypugaea</i>	SOC	State Protected
Juniper Titmouse	<i>Baeolophus griseus</i>	---	State Protected
Ferruginous Hawk	<i>Buteo regalis</i>	SOC	State Protected
Swainson's Hawk	<i>Buteo swainsoni</i>	---	State Protected
Sage Grouse	<i>Centrocercus urophasianus</i>	---	State Protected
Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>	Threatened	State Protected
Mountain Plover	<i>Charadrius montanus</i>	Proposed Threatened	State Protected
Black Tern	<i>Chlidonias niger</i>	SOC	State Protected
Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>	Candidate	State Protected
Yellow Warbler	<i>Dendroica petechia</i>	---	State Protected
Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	Endangered	State Protected
Prarie Falcon	<i>Falco mexicanus</i>	---	State Protected
Common Yellowthroat	<i>Geothlypis trichas</i>	---	State Protected
Greater Sandhill Crane	<i>Grus canadensis tabida</i>	---	State Protected
Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	---	State Protected
Yellow-breasted Chat	<i>Icteria virens</i>	---	State Protected
Western Least Bittern	<i>Ixobrychus exilis hesperis</i>	SOC	State Protected
Loggerhead Shrike	<i>Lanius ludovicianus</i>	SOC	State Protected
Lewis' Woodpecker	<i>Melanerpes lewis</i>	---	State Protected
Long-billed Curlew	<i>Numenius americanus</i>	---	State Protected
Macgillivray's Warbler	<i>Oporornis tolmiei</i>	---	State Protected
Mountain Quail	<i>Oreortyx pictus</i>	---	State Protected
Flammulated Owl	<i>Otus flammeolus</i>	---	State Protected
Osprey	<i>Pandion haliaetus</i>	---	State Protected
Phainopepla	<i>Phainopepla nitens</i>	---	State Protected
White-faced Ibis	<i>Plegadis chihi</i>	SOC	State Protected
Vesper Sparrow	<i>Poocetes gramineus</i>	---	State Protected
Yuma Clapper Rail	<i>Rallus longirostris yumanensis</i>	Endangered	State Protected
Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>	---	State Protected
Crissal Thrasher	<i>Toxostoma crissale</i>	---	State Protected
Orange-crowned Warbler	<i>Vermivora celata</i>	---	State Protected
Lucy's Warbler	<i>Vermivora luciae</i>	---	State Protected
Grey vireo	<i>Vireo vicinior</i>	---	State Protected

SOC = Species of Concern

agency goals is support to the development and implementation of environmental compliance audit programs and policies “that emphasize pollution prevention as a means to both achieve and maintain environmental compliance.” Sandia Corporation is working under guidance from DOE/NNSA/SSO toward compliance with this EO.

2.2 2004 AUDITS

[Table 2-3](#) lists audits conducted in 2004, including an assessment made by Sandia Corporation.

2.3 2004 ISSUES AND ACTIONS FOR TTR

Sandia Corporation’s ongoing self-assessments continue to look for potential compliance issues and subsequent follow-up actions.

Federal Facility Agreement and Consent Order (FFACO) Compliance for ER Activities

An ongoing action started in 1996 is the FFACO with the State of Nevada. This agreement was implemented in May 1996 between the State of Nevada, DOE, and the U.S. Department of Defense (DoD) ([DoD/DOE/State of NV 1996](#)). All DOE cleanup activities in the State of Nevada must be conducted in conformance with the requirements of this agreement. The FFACO is an enforceable agreement with stipulated penalties for violations. The ER sites for which DOE has assumed responsibility, and which are subject to the FFACO:

- NTS,
- Areas within TTR,
- Areas within the NTTR,
- Central Nevada Test Area, and
- Project Shoal Area (east of Carson City in Churchill County).

A summary of DOE/NNSA’s ER sites in Nevada can be found in the FFACO report (DOD/DOE/State of NV 1996). The list of sites has been modified for consistency with NDEP requirements and grouped into Corrective Action Units (CAUs), which are listed by Corrective Action Site (CAS) numbers. Each CAU is listed in the FFACO under Appendices II (inactive CAUs) and III (active CAUs) and are updated every six months. A listing of ER sites located at TTR is shown in [Chapter 3, Table 3-1](#).

2.4 ENVIRONMENTAL PERMITS

Environmental compliance permits for TTR include those for potable water supply, RCRA, and specific air emission units, such as screening plants. The permit application and registration of Sandia Corporation activities at TTR are issued directly by the State of Nevada to either DOE/NNSA, Nevada Site Office (NSO) or DOE/NNSA/SSO and administered by Westinghouse Government Service on behalf of Sandia Corporation. Sandia Corporation and Westinghouse Government Service ensure that all permit conditions are met. [Table 2-4](#) lists all permits and registrations in effect in 2004.

2.5 OCCURRENCE REPORTING

There were no reportable occurrences in 2004.

TABLE 2-3. Summary of Environmental Audits Performed at TTR in 2004

Type/Subject	Date	Audit Organization	Findings Summary
Spill Prevention Counter Control Measures	April 2004	NNSA/SSO	One Finding (Plan not up to date) Seven Observations and Five Noteworthy comments.
ES&H Self-Assessment of the Tonopah Test Range	May 2004	SNL Center 15000	Numerous Observations mostly related to training.
Air Quality	June 2004	State of Nevada	There were no findings.
Quality Assessment of the Tonopah Test Range	May - July 2004	NNSA/SSO	Numerous findings mostly related to Emergency Management.

NOTE: NNSA/SSO = National Nuclear Security Administration, Sandia Site Office

TTR = Tonopah Test Range

ES&H = Environment, Safety, and Health

TABLE 2-4. 2004 Summary of Permit Ownership at TTR

Permit Type and Location	Permit Number	Issue Date	Expiration Date	Comments
Air Quality Permits				
Class II Air Quality Operation Permit	AP9611-0680.01	July 23, 2001	July 23, 2006	1- 3' x 5' Screening Plant 1- 7' x 7' Portable Screen Non-Permit Equipment List Generators (53 emission units) Boilers (7 emission units) Maintenance Activities (5 emission units) Propane Storage Tanks (23 emission units) Surface Area Disturbance (> 5 acres)
RCRA - Hazardous Waste				
Hazardous Waste Generator	NV1890011991	January 7, 1993	Indefinite	State of Nevada
Production Well (Drinking Water)				
Well 6 Production Well	NY-3014-12NC	September 2003	September 2004*	State of Nevada

NOTE: * The State of Nevada Bureau of Health Protection Services renews the permit for Well 6 (NY-3014-12NC) annually.

TTR = Tonopah Test Range

RCRA = Resource Conservation and Recovery Act

"Emission units" are sources such as generators and boilers.

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chapter three

TTR ENVIRONMENTAL PROGRAMS INFORMATION

In This Chapter ...

ER Project Activities
Waste Management Programs
Spill Prevention Control and
Countermeasures Plan
National Environmental Policy
Act
Environmental Monitoring
Performed by Outside Agencies
Summary of Release Reporting

Environmental Snapshot

In 2004, investigation activities at Environmental Restoration sites generated a total of 255 kg (495 lb) of waste including 200 kg (440 lb) of non-RCRA waste and 25 kg (55 lb) of RCRA hazardous waste.



View of Mountain Range at Tonopah Test Range

The Environmental Restoration (ER) Project, the Waste Management Program, and the National Environmental Policy Act (NEPA) Program are some of the programs and activities Sandia Corporation's Tonopah Test Range (TTR) utilizes to meet compliance with various state and federal regulations, Executive Orders (EOs), and U.S. Department of Energy (DOE) Orders. Terrestrial surveillance, drinking water, wastewater, and air quality programs are discussed in Chapter 4 of this report.

3.1 ER PROJECT ACTIVITIES

The ER Project at TTR began in 1980 to address contamination resulting primarily from nuclear weapons testing and related support activities. In late 1992 and early 1993, an agreement was reached between DOE Headquarters (HQ), the DOE/National Nuclear Security Administration (NNSA) Service Center and the DOE, Nevada Site Office (NSO) regarding the management of ER activities at TTR. The decision was made to designate the responsibility of all ER sites to DOE/NSO.

Since 1996, cleanup activities for sites located in the State of Nevada have been regulated by the Federal Facility Agreement and Consent Order (FFACO) (DoD/DOE/State of NV 1996). The FFACO was negotiated between DOE/NSO, the Nevada Division of Environmental Protection (NDEP), and the U.S. Department of Defense (DoD). The FFACO took effect on May 10, 1996 and accomplished the following:

- Established a framework for identifying Corrective Action Sites (CASs),
- Grouped CASs into Corrective Action Units (CAUs),
- Prioritized CAUs, and
- Implemented corrective action activities.

The FFACO is also discussed in Section 2-3. CAUs located at TTR are addressed by two ER Division Projects:

(1) Industrial Sites Project – Past sites used to support nuclear testing activities, and

(2) Soil Sites Project – Areas where tests resulted in extensive surface and/or shallow subsurface contamination.

ER site contamination includes radiological (e.g., depleted uranium [DU] and plutonium) and non-radiological constituents (e.g., artillery, solvents, septic sludges, and heavy metals).

CAS Identification

The initial identification, description, and listing of CASs at TTR were derived from the Preliminary Assessment (PA) and the *Federal Facility Preliminary Assessment Review* (E&E 1989). In 1993, the potential TTR CASs identified in the PA were subdivided into four “Soil Sites CAUs” and 43 “Industrial Sites CAUs.” Twelve additional potential CASs not included in the PA were also identified. These CASs were identified through:

- ER sites inventory process,
- Ordnance removal activities,
- Geophysical surveys,
- Former worker interviews,
- Archive reviews,
- Site visits, and
- Aerial radiological and multispectral surveys (1993 to 1996).

The remediation activities at the Clean Slate and Double Tracks sites (Project Roller Coaster) are discussed in Chapter 1. These sites are listed under Soil Sites CAUs/CASs in Table 3-1 as CAU-411, -412, -413, and -414.

Table 3-1 summarizes the existing Industrial and Soil Sites CAUs and CASs at TTR. The ER activities planned for these CASs range from “no activities currently planned” to “NDEP-approved closure.” The CAS information presented in Table 3-1 is contained in Appendices II, III, and IV of the FFACO (DoD/DOE/State of NV 1996).

2004 ER Activities

In 2004, ER activities were focused on investigation and delineation of corrective action sites in preparation for cleanup activities. Investigation activities at ER sites generated a total of 255 kg (495 lb) of waste including 200 kg (440 lb) of non-Resource Conservation and Recovery Act (RCRA) waste and 25 kg (55 lb) of RCRA hazardous waste. RCRA waste consisted of spent field-testing kits and associated debris. All RCRA waste was transported to the Nevada Test Site (NTS) for processing and disposal at a permitted treatment, storage, and disposal (TSD) facility. No low-level waste (LLW)

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs Calendar Year (CY) 2004 Status

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-400 - Closed		
<u>Bomblet Pit and Five Points Landfill, TTR</u>		
TA-19-001-05PT	Ordnance Disposal Pit	Five Points Intersection
TA-55-001-TAB2	Ordnance Disposal Pit	Bunker 2 Road
CAU-401 - Closed		
<u>Area 3 Gas Station UST Site, TTR</u>		
03-02-003-0357	UST, Gas	First Gas Station, Area 3
CAU-402 - Closed		
<u>Area 3 Bldg. 0353 UST Site, TTR</u>		
03-02-001-0353	UST, Diesel	Bldg. 0353
CAU-403 - Closed		
<u>Area 3 Second Gas Station UST, TTR</u>		
03-02-004-0360	USTs	Second Gas Station
CAU-404 - Closed		
<u>Roller Coaster Lagoons and Trench, TTR</u>		
TA-03-001-TARC	Roller Coaster Lagoons	NW of Antelope Lake
TA-21-001-TARC	Roller Coaster North Disposal Trench	NW of Antelope Lake
CAU-405 - Closed		
<u>Area 3 Septic Systems, TTR</u>		
03-05-002-SW03	Septic Waste System	Area 3
03-05-002-SW04	Septic Waste System	Area 3
03-05-002-SW07	Septic Waste System	Area 3
CAU-406 - Closed		
<u>Area 3 Bldg. 03-74 and Bldg. 03-58 UDPs, TTR</u>		
03-51-002-0374	Heavy Duty Shop UDP, Sumps	Bldg. 0374
03-51-003-0358	UPS Building UDP	UPS Building, Area 3
CAU-407 - Closed		
<u>Roller Coaster Rad Safe Area, TTR</u>		
TA-23-001-TARC	Roller Coaster Rad Safe Area	Northwest of Antelope Lake
CAU-408 - Not Started		
<u>Bomblet Target Area, TTR</u>		
TA-55-002-TAB2	Bomblet Target Areas	Antelope Lake
CAU-409 - Closed		
<u>Other Waste Sites, TTR</u>		
RG-24-001-RGCR	Battery Dump Site	Cactus Repeater
TA-53-001-TAB2	Septic Sludge Disposal Pit	Bunker 2
TA-53-002-TAB2	Septic Sludge Disposal Pit	Bunker 2
CAU-410 - Closed		
<u>Area 9 Underground Vault and Disposal Trench, TTR</u>		
09-21-001-09MG	Former Bunker or Underground Vault	East of Area 9 Magazines
09-21-001-TA09	Disposal Trenches	Area 9
TA-19-002-TAB2	Debris Mound	Bunker 2
TA-21-003-TANL	Disposal Trench	NEDS Lake
TA-21-002-TAAL	Disposal Trench	South Antelope Lake

Refer to notes at end of table.

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs CY 2004 Status (continued)

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-423 – Closed		
<i>Area 3 UDP Bldg. 0360, TTR</i>		
03-02-002-0308	UDP	Bldg. 0360
03-02-002-0308	UDP	Bldg. 0360
CAU-424 – Closed		
<i>Area 3 Landfill Complex, TTR</i>		
03-08-001-A301	Landfill Cell A3-1	Area 3 Landfill Complex
03-08-002-A302	Landfill Cell A3-2	Area 3 Landfill Complex
03-08-002-A303	Landfill Cell A3-3	Area 3 Landfill Complex
03-08-002-A304	Landfill Cell A3-4	Area 3 Landfill Complex
03-08-002-A305	Landfill Cell A3-5	Area 3 Landfill Complex
03-08-002-A306	Landfill Cell A3-6	Area 3 Landfill Complex
03-08-002-A307	Landfill Cell A3-7	Area 3 Landfill Complex
03-08-002-A308	Landfill Cell A3-8	Area 3 Landfill Complex
CAU-425 – Closed		
<i>Area 9 Main Lake Construction Debris Disposal Area, TTR</i>		
09-08-001-TA09	Construction Debris Disposal Area	Area 9/Main Lake
CAU-426 – Closed		
<i>Cactus Spring Waste Trenches, TTR</i>		
RG-08-001-RGCS	Waste Trenches	Cactus Spring Ranch
CAU-427 – Closed		
<i>Area 3 Septic Waste Systems 2 and 6, TTR</i>		
03-05-002-SW02	Septic Waste System No. 2	Area 3
03-05-002-SW06	Septic Waste System No. 6	Area 3
CAU-428 – Closed		
<i>Area 3 Septic Waste Systems 1 and 5, TTR</i>		
03-05-002-SW01	Septic Waste System No. 1	Area 3
03-05-002-SW05	Septic Waste System No. 5	Area 3
CAU-429 – Closed		
<i>Area 3 Bldg. 03-55 and Area 9 Bldg. 09-52 UDPs, TTR</i>		
03-51-001-0355	Photo Shop UDPs, Drains	Photo Shop Area 3
09-51-001-0952	Mobile Photographic Lab UDPs	Area 9
CAU-430 – Closed		
<i>DU Artillery Round #1, TTR</i>		
TA-55-003-0960	DU Artillery Round	South of Area 9
CAU-453 – Closed		
<i>Area 9 UXO Landfill, TTR</i>		
09-55-001-0952	Area 9 Landfill	Area 9
CAU-461 – Closed		
<i>Test Area JTA Sites, TTR</i>		
TA-52-002-TAML	DU Impact Site	Main Lake
TA-52-003-0960	DU Artillery Round #2	South of Area 9
TTR-001	1987 W-79 JTA	Unknown – South of Area 9
CAU-484 – Investigation Phase		
<i>Antelope and NEDS Lakes Waste Sites, TTR</i>		
TA-52-001-TANL	NEDS Detonation Area	NEDS Lake
TA-52-004-TAAL	Metal Particle Dispersion Test	Antelope Lake
TA-52-005-TAAL	JTA DU Sites	Antelope Lake
TA-54-001-TANL	Rocket Propellant Burn Area	NEDS Lake
RG-52-007-TAML	Davis Gun Site – Mellan	Test Range
TA-52-006-TAPL	DU Surface Debris	Colimbo Detonation Area, NEDS Lake

TABLE 3-1. DOE/NNSA/NSO ER Project TTR CAUs and CASs CY 2004 (concluded)

Industrial Sites CAUs/CASs		
CAS Number	CAS Description	General Location
CAU-485 - Closed		
<u>Cactus Spring Ranch Pu and DU Site, TTR</u>		
TA-39-001-TAGR	Cactus Spring Ranch, Soil Contamination	West of Target Areas
CAU-486 - Closed		
<u>Double Tracks Rad Safe Area, Nellis Range 71 North</u>		
71-23-001-71DT	Double Tracks Rad Safe Area	Nellis Range 71 North
CAU-487 - Closed		
<u>Thunderwell Site, TTR</u>		
RG-26-001-RGRV	Thunderwell Site	Thunderwell Site
CAU-489 – Investigation Phase		
<u>WWII UXO Sites, TTR</u>		
RG-55-001-RGMN	WWII Ordnance Site	Mellan Airstrip
RG-55-002-RGHS	WWII Ordnance Site	H-Site Road
RG-55-003-RG36	WWII Ordnance Site	Gate 36E
CAU-490 - Closed		
<u>Station 44 Burn Area, TTR</u>		
RG-56-001-RGBA	Fire Training Area	Station 44
03-56-001-03BA	Fire Training Area	Area 3
03-58-001-03FN	Sandia Service Yard	Area 3
09-54-001-09L2	Solid Propellant Burn Site	Area 9
CAU-495 - Closed		
<u>Unconfirmed JTA Sites, TTR</u>		
TA-55-006-09SE	Buried Artillery Round	Test Area
TA-55-007-09SE	Buried Artillery Round	Test Area
CAU-496 – Investigation Phase		
<u>Buried Rocket Site – Antelope Lake, TTR</u>		
TA-55-008-TAAL	Buried Rocket	Antelope Lake
CAU-499 - Closed		
<u>Hydrocarbon Spill Site, TTR</u>		
RG-25-001-RD24	Hydrocarbon Spill Site	Radar 24 Site
Soil Sites CAUs/CASs:		
CAU-411 - Closed		
<u>Double Tracks Plutonium Dispersion, Nellis</u>		
NAFR-23-01	Pu-contaminated Soil	Double Tracks
CAU-412 - Closed		
<u>Clean Slate 1 Plutonium Dispersion, TTR</u>		
TA-23-01CS	Pu-Contaminated Soil	Clean Slate 1
CAU-413 - Remediation Phase		
<u>Clean Slate 2 Plutonium Dispersion, TTR</u>		
TA-23-02CS	Pu-Contaminated Soil	Clean Slate 2
CAU-414 - Not Started		
<u>Clean Slate 3 Plutonium Dispersion, TTR</u>		
TA-23-03CS	Pu-Contaminated Soil	Clean Slate 3

SOURCE: DoD/DOE/State of NV 1996 and ongoing updates

NOTE: DOE = U.S. Department of Energy
CAU = Corrective Action Unit
CAS = Corrective Action Site
DU = depleted uranium
ER = Environmental Restoration
NEDS = Non-Explosive Destruction Site
WWII = World War II
Pu = Plutonium

NNSA = National Nuclear Security Administration
NSO = Nevada Site Office
UDP = underground discharge points
UST = underground storage tank
UXO = unexploded ordnance
TTR = Tonopah Test Range
JTA = Joint Test Assembly

or mixed waste was generated during ER activities at TTR or disposed during 2004. One drum of non-impacted personal protective equipment (PPE) was disposed of at the U.S. Air Force (USAF) sanitary landfill in 2004. No sanitary rinsate was disposed of in the TTR sanitary lagoons in 2004. Westinghouse Government Service participates in environmental cleanup and restoration activities.

3.2 WASTE MANAGEMENT PROGRAMS

All waste generated by Sandia Corporation activities at TTR is managed by Westinghouse Government Service under the Waste Management Program. (Sandia Corporation does not handle waste generated by ER activities.) Waste categories include radioactive waste, RCRA-hazardous waste, other chemical waste, and non-hazardous solid waste. Waste minimization and recycling efforts are integrated into Waste Management Program activities. Waste generated and handled by Sandia Corporation at TTR in 2004 was as follows:

<i>Waste Type</i>	<i>Weight</i>
RCRA hazardous waste	942 kg (2,078 lb)
Non-RCRA-regulated	3,768 kg (8,306 lb)
Recycled Waste	3,671 kg (8,093 lb)
Radioactive waste	0 kg

Sandia Corporation shipped all regulated waste to off-site permitted TSD facilities.

Table 3-2 shows a detailed breakdown of the RCRA waste categories and quantities. Table 3-3 lists regulated non-RCRA waste categories and quantities. Table 3-4 lists waste categories transported off-site for recycling or alternative fuel use. A *Hazardous Waste Biennial Report* is prepared by SNL/NM and submitted to the U.S. Environmental Protection Agency (EPA) through DOE/NNSA/NSO (SNL 2004a).

Waste Minimization Program

TTR is committed to achieving significant reductions in the amount of chemical and hazardous wastes generated on-site. Waste minimization includes recycling and recovery of the following materials:

- Solvents,
- Fuels and oil,

- Antifreeze (on-site recycling unit),
- Lead acid batteries,
- Freon (on-site recovery unit),
- Fluorescent and sodium bulbs, and
- Mercury-containing equipment.

Recyclable waste and used oil was sent for recycling or disposed of through the waste disposal contractor.

Radioactive Waste Management

There were no shipments of radioactive waste in 2004.

3.3 SPILL PREVENTION CONTROL AND COUNTERMEASURES (SPCC) PLAN

The *SPCC Plan for SNL Tonopah Test Range* (SNL 1999), which was revised in 2004, pertains to oil storage equipment and secondary containments subject to 40 CFR 112, “Oil Pollution Prevention” and 40 CFR 110, “Discharge of Oil.”

There are three aboveground storage tanks (ASTs), two bulk storage areas (BSA), and one transformer storage area that are regulated with a capacity of greater than 660 gallons that are applicable to the SPCC Plan at TTR.

3.4 NEPA PROGRAM

NEPA Activities at TTR

At TTR, NEPA compliance is coordinated between Sandia Corporation at TTR, Sandia Corporation at Sandia National Laboratories, New Mexico (SNL/NM), and DOE/NNSA, Sandia Site Office (SSO). Additionally, under the direction of Sandia Corporation, compliance is supported by the Water Resources Center at the Desert Research Institute (DRI) through the University of Nevada System. DRI prepares archaeological and biological surveys and reports. Final reports are submitted to Sandia Corporation for transmittal to DOE/NNSA/SSO for review and decision-making and consultation with state and federal agencies.

The Final Environmental Impact Statement (EIS) for the NTS and Off-Site Locations in the State of Nevada, which includes the TTR site, was completed in 1996; the DOE Record of Decision (ROD) was filed on December 9, 1996 (DOE 1996).

TABLE 3-2. Sandia Corporation TTR Generated RCRA-Regulated Hazardous Waste Shipped Off-site in 2004

Waste Description	Waste Codes	Generated (lb)
WASTE MANAGEMENT		
Waste Toxic Solid, Organic, NOS	D035, F002, F005	50
Waste (Lithium Battery)	D001, D003	5
Waste Aerosols	D001	122
Waste Paint Related Material	D001	165
Waste Flammable Liquids	D001	169
Waste Flammable Liquids, NOS	D001, D035	715
Waste, Gasoline/Diesel Fuel	D001, D018	25
Waste Diesel Fuel	D001	60
Waste Corrosive Liquid, Basic, Inorganic, NOS	D002, D007, D011	200
Waste Corrosive Liquid, Organic, NOS	D002, D010	10
Hazardous Waste, Solid, NOS	D008	170
Hazardous Waste, Solid, NOS	D008, D009	121
Hazardous Waste, Liquid, NOS	D007, D011	186
Hazardous Waste, Liquid, NOS	D006, D007, D011	80
TOTAL		2,078

NOTE: NOS = not otherwise specified
TTR = Tonopah Test Range

RCRA = Resource Conservation and Recovery Act
lb = pounds

TABLE 3-3. Non-RCRA-Regulated Hazardous or Toxic Waste Shipped Off-site in 2004

Waste Description	Waste Codes	Shipped	Generated (lb)
Non-Reg Solid Waste	NCR		7,510
Non-Reg Liquid Waste	NCR		730
Environmentally Hazardous Substances, Liquid, NOS (Copper Sulfate)	NCR		35
Polychlorinated Biphenyl's (PCB) Ballasts	TSCA		31
TOTAL			8,306
D&D Asbestos Waste	TSCA	8 yd ³	8 yd ³
Environmental Restoration (ER)			
Hydrocarbon impacted soil & debris			0
IDW		200	200
LLW (soil, debris, and PPE)			0
Inert UXO debris			0
TOTAL			200

NOTE: NCR = no code required

RCRA = Resource Conservation and Recovery Act

IDW = Investigation-Derived Waste

D & D = decontamination and demolition

yd³ = cubic yard

TSCA = Toxic Substances Control Act

LLW = low level waste

UXO = unexploded ordnance

PPE = personal protective equipment

lb = pounds

TABLE 3-4. Recycled Regulated Hazardous or Toxic Waste Shipped Off-site in 2004

Recycled Material or Energy Recovered Material	Generated (lb)
Batteries Wet, Filled with Acid	645
Lead For Recycle	5
Automotive Batteries	5,978
Batteries Dry Containing Potassium Hydroxide Solid	655
Fluorescent Lights	360
Used Oil	370
Antifreeze (Ethylene Glycol)	30
Circuit Boards for Recycle	50
TOTAL	8,093

NOTE: lb = pounds

2004 NEPA Documentation

A total of six NEPA reviews were processed during 2004. Two NEPA reviews were completed by SNL/NM. Four NEPA checklists were submitted to SSO for review. Three of these checklists were found to be categorically excluded and one NEPA checklist is pending a decision at SSO.

3.5 ENVIRONMENTAL MONITORING PERFORMED BY OUTSIDE AGENCIES

In addition to Sandia Corporation, other agencies perform environmental monitoring activities at TTR, as described below.

EPA

The EPA Environmental Monitoring Systems Laboratory in Las Vegas, NV, monitored background radiation in the area of TTR as part of its Off-site Radiation Monitoring Reports Program ([EPA 1999](#)), which is now being done by DRI.

DRI, University of Nevada System

The DRI trains and provides monitoring station managers (generally they are local science teachers) to run the EPA air monitoring equipment set up at locations within the local community including the towns of Tonopah and Goldfield. The EPA laboratory in Las Vegas, Nevada provides the equipment and performs the analysis and reporting.

DRI also provides external quality assurance (QA) on field measurements taken by the EPA at these community-monitoring stations. DRI monitors selected locations concurrently using a portable monitoring station (PMS) and thermoluminescent dosimeters (TLDs). DRI's *Community Radiation Monitoring Program Annual Report* now appears as part of the NTS Annual Site Environmental Report (ASER) ([DOE 2004](#)).

DRI also performs other monitoring—primarily hydrological—for the DOE, as requested. This may include evaluating environmental impacts due to construction projects at TTR.

Westinghouse Government Service

As part of its TTR support activities, Westinghouse Government Service personnel perform environmental monitoring activities for DOE and/or Sandia Corporation when needed as follows:

- Drinking water and wastewater sampling;
- National Emission Standards for Hazardous Air Pollutants (NESHAP) 40 CFR 61, Subpart H (radionuclides) air quality monitoring;
- Soil sampling and site characterization of spill sites;
- Waste sampling and characterization; and
- ER support activities.

3.6 SUMMARY OF RELEASE REPORTING

The following four release reporting documents must be submitted to external regulatory agencies if releases exceed applicable threshold quantities (TQ):

- *NESHAP Annual Report for CY 2004, SNL/NV* ([SNL 2005](#)), requires that an annual report be submitted from each DOE/NNSA site where facility sources contribute a public dose of over 0.1 mrem/yr. The NESHAP report must be submitted to the EPA by June 30th each year, following the reporting year. The report includes the calculated effective dose equivalent (EDE) in mrem/yr for the maximally exposed individual (MEI).
- *State of Nevada Reports* – The State of Nevada requires copies of each hazardous waste manifest that accompanies each waste shipment.
- *State of Nevada Extremely Hazardous Material Reporting Requirements* – This is not currently required since Sandia Corporation does not use any extremely hazardous materials during its routine operations.
- *Toxic Chemical Release Reporting Community Right-to-Know: Calendar Year 2004* ([SNL 2004](#)) submitted for lead released at the TTR firing range.

chapter four

TTR ENVIRONMENTAL MONITORING

In This Chapter ...

Terrestrial Surveillance
Water Monitoring
Radiological Air Monitoring
Non-radiological Air Emissions

Environmental Snapshot

Soil is the only terrestrial medium sampled at TTR. There are no bodies of water, other than the playa lakes (dry lake beds with only occasional standing water), and vegetation is scarce.



Abandoned Shack at Tonopah Test Range

4.1 TERRESTRIAL SURVEILLANCE

Terrestrial surveillance is conducted at the Tonopah Test Range (TTR) to detect the possible migration of contaminants to off-site locations and to determine the potential impact of Sandia Corporation's operations on human health or the environment.

4.1.1 Program Objectives

The objectives of the Terrestrial Surveillance Program can be summarized by the following excerpts of the requirements given in U.S. Department of Energy (DOE) Order 450.1, *Environmental Protection Program* (DOE 2005):

- Collect and analyze samples to characterize environmental conditions and define increasing or decreasing trends;
- Establish background levels of pollutants to define baseline conditions (off-site sampling);
- Provide continuing assessment of pollution abatement programs;
- Identify and quantify new or existing environmental quality problems and their potential impacts, if any; and
- Verify compliance with applicable environmental laws and regulations and commitments made in National Environmental Policy Act (NEPA) documents, such as Environmental Impact Statements (EISs), as well as other official documents.

4.1.2 Regulatory Standards and Comparisons

The Terrestrial Surveillance Program is designed and conducted in accordance with the requirements of DOE Order 450.1, *Environmental Protection Program* (DOE 2005). Concentration limits for radionuclides and metals in terrestrial media are not well defined; however, the Environmental Management (EM) Department does compare the results from on-site and perimeter locations to off-site results to determine the impact, if any, of Sandia Corporation's operations on the environment. In addition, sample results for metal in surface soils are compared to U.S. surface soil average concentrations, published in *Trace Elements in Soils and Plants* (Kabata-Pendias and Pendias, 2000), or

local/regional surface soil average concentrations, published in *Elements in North American Soils* (Dragun and Chekiri, 2005).

4.1.3 Statistical Analyses

Samples are generally collected from fixed locations to effectively make statistical comparisons with results from previous years. Statistical analyses are performed to determine if a specific result or group of on-site or perimeter results, differs from off-site values, and to identify trends at a specific sampling location. Since multiple data points are necessary to provide an accurate view of a system, the Terrestrial Surveillance Program does not rely on the results from any single year's sampling event to characterize on-site environmental conditions. Results from a single sampling point may vary from year to year, due to slight changes in sampling locations, differences in climatic conditions, and laboratory variations or errors. Therefore, as the amount of data increases, the accuracy of the characterization increases.

The results of the statistical analyses allow the EM Department to prioritize sample locations for possible follow-up action. The prioritization process is a decision-making tool to assist in determining the appropriate level of concern for each sample result. The Statistical Analysis Prioritization Method (Shyr, Herrera, and Haaker, 1998) is based on two "yes or no" questions resulting in a matrix of four priority levels (Table 4-1). In addition, a qualitative, visual inspection of a graphical presentation of the data is conducted to compare sampling results to regional/local and site-specific concentrations. This step is performed to ensure that anomalous data that would otherwise pass statistical scrutiny is flagged for further investigation.

To date, there have been no terrestrial sample results that have indicated a significant level of concern (Priority-1) that would trigger actions at locations that are not already being addressed by the Environmental Restoration (ER) Project.

In past years, the period of time covered by the statistical analysis was from 1994 to present. In calendar year 2001, the analysis was limited to a five-year period (this year beginning in 1999). The reason for the change was that SNL/NM changed analytical laboratories in 2000, with lower detection capabilities for many of the metals and

TABLE 4-1. Decision Matrix for Determining Priority Action Levels

Priority	Are results higher than off-site?*	Is there an increasing trend ?	Priority for further investigation
1	Yes	Yes	Immediate attention needed. Specific investigation planned and/or notifications made to responsible parties.
2	Yes	No	Some concern based on the level of contaminant present. Further investigation and/or notifications as necessary.
3	No	Yes	A minor concern since contaminants present are not higher than off-site averages. Further investigation and/or notifications as necessary.
4	No	No	No concern. No investigation required.

NOTE: Based on Statistical Analysis Prioritization Methodology (Shyr, Herrera, and Haaker 1998).

*While some sites may appear higher than off-site, there may not be a statistically significant difference.

radiological analyses. As a result, a large number of false decreasing trends were noted for many of the parameters when the whole data set was analyzed. By limiting the analysis to a five-year period, the number of apparent decreasing trends was reduced, and should be eliminated over the next couple of years.

4.1.4 Sampling Locations

Terrestrial surveillance began at TTR in 1992. In addition to routine sampling, a large-scale baseline sampling was performed in 1994 in areas where Sandia Corporation had a long-term or continued presence.

Routine terrestrial surveillance is conducted at on-site, perimeter, and off-site locations that remain essentially the same from year to year. The sampling locations, number of samples, and analyses performed are prioritized based on the following criteria:

- **On-site locations** are near areas of known contamination, potential sources of contamination, or in areas where contamination, if present, would be expected to accumulate, such as in the vicinity of ER sites. A list of on-site sampling locations is shown in [Table 4-2](#). Appendix A contains maps of the sampling locations. A total of 21 locations were sampled on-site.
- **Off-site locations** are selected to provide a measurement of environmental conditions unaffected by Sandia Corporation's activities at TTR. Data collected from off-site locations serve as a reference point to compare data

collected at perimeter and on-site locations. Multiple years of sampling data are compiled to determine statistical averages for off-site concentrations. Off-site locations are chosen both in remote, natural settings as well as in areas near local population centers and along highways. [Table 4-3](#) contains a list of the off-site sample locations. The 14 off-site locations sampled are shown in [Figure A-1 of Appendix A](#).

- **Perimeter locations** are selected to establish if contaminants are migrating either onto or off Sandia Corporation property at TTR. A list of perimeter sampling locations is shown in [Table 4-4](#). A map of the eight perimeter locations is shown in [Figure A-2 of Appendix A](#). All perimeter locations are in areas to which Sandia Corporation does not control access within TTR.

4.1.5 Radiological Parameters and Results

Soil is the only terrestrial medium sampled at TTR. There are no bodies of water, other than the playa lakes (dry lake beds with only occasional standing water), and vegetation is scarce. Soil samples are collected to ascertain the presence of air-deposited pollutants or contaminants that have been transported and deposited as a result of surface water runoff. Samples are collected from the top two inches of soil using a hand trowel. The 2004 analytical results are found in [Appendix A](#) of this report and are summarized in this section. The detailed statistical analyses are documented in the *Tonopah Test Range Data Analysis in Support of the Annual Site Environmental Report, 2004* ([SNL 2005a](#)). Radiological parameters include gamma-emitting radionuclides, plutonium and uranium.

TABLE 4-2. On-Site Terrestrial Surveillance Locations at TTR

<i>On-Site Location</i>	<i>Revised Location Number</i>	<i>Old Location Number</i>	<i>Sample Location</i>	<i>Soil Sampling</i>	<i>Replicate</i>	<i>TLD</i>
South Plume	S-48	T-14	N/S Mellan Airstrip – Antelope Tuff	√	√	
	S-49	T-16	N/S Mellan Airstrip – SW of S-48	√		
	S-50	T-17	N/S Mellan Airstrip – sign post	√		
	S-51	T-18	N/S Mellan Airstrip – NE of S-50	√	√	
	S-52	T-19	NE of NW/SE Mellan Airstrip	√		
Range Operations Center	S-40	OC-02	Waste Water Monitoring Station	√		
	S-41	OC-03	“Danger Powerline Crossing” Sign	√		
	S-42	OC-04	Main Road/Edward’s Freeway	√		
	S-43	OC-10	SW Corner of Sandia Corporation, TTR Operations Center	√		
	S-44	OC-13	NE Corner of Sandia Corporation, TTR Operations Center	√		
	S-45	OC-19	Storage Shelters, 03-38/03-39	√		
	S-46	OC-22	Sand Building	√		
	S-47	OC-23	Generator Storage Area	√		
Various On-Site Locations	S-01	T-01	Antelope Lake Area Fence, Cultural Area Sign			√
	S-02	T-02	N/S Mellan Airstrip (TLD at South fence post)	√		√
	S-03	T-03	TLD at Clean Slate 2	√	√	√
	S-04	T-04	TLD at Clean Slate 3	√		√
	S-09	D-10	Roller Coaster Decon	√	√	√
	S-10	T-10	Brownes Road/Denton Freeway	√		√
	S-13	T-13	Area 3 between Bldg. 100 and Caution Sign			√
	S-14	T-14	Area 3 CP SW side on fence			√
	S-15	T-15	Moody Ave. by cattle guard and entrance to airport and chow hall			√
	S-16	S-16	Area 9 by Bldg. 09-08 and LPG storage			√
	S-17	S-17	Hard Target area by Bldg. 23-16			√
	S-38	MH-03	Mellan Hill – Metal Scrap Pile	√		
	S-39	MH-04	Mellan Hill – North	√		
	S-53	T-20	Main Road/Lake Road SE	√		

NOTE: TLD = Thermoluminescent Dosimeter

TTR = Tonopah Test Range

N/S = North/South (runway runs North/South)

*In addition to single samp □

TABLE 4-3. Off-Site Terrestrial Surveillance Locations at TTR

<i>On-Site Location</i>	<i>Revised Location Number</i>	<i>Old Location Number</i>	<i>Sample Location</i>	<i>Soil Sampling</i>	<i>Replicate</i>	<i>TLD</i>
Off-Site	C-18	T-18	Tonopah Old Court House			
	C-19	T-19	Mining Museum, North Goldfield			√
	C-20	B-08	State Road 6 Rest Area	√		
	C-21	B-04	State Road 6/95 Rest Area	√		√
	C-22	B-07	Rocket	√		√
	C-23	B-01	Alkali/Silver Peak Turnoff	√		
	C-24	B-02	Cattle Guard	√		
	C-25	B-03	Tonopah Ranger Station	√		
	C-26	B-05	Gabbs Pole Line Road	√		
	C-27	B-06	State Roads 6/376 Junction	√		
	C-28	B-09	Stone Cabin/Willow Creek	√		
	C-29	B-10	State Roads 6/375 Junction	√	√	
	C-30	B-11	State Road 375 Ranch Cattle Gate	√		
	C-31	B-12	Golden Arrow/Silver Bow	√		
	C-32	B-13	Five miles south of Rocket	√		
	C-33	B-14	Nine miles south of Rocket	√		

NOTE: TLD = Thermoluminescent Dosimeter

TTR = Tonopah Test Range

*In addition to single samp □

TABLE 4-4. Perimeter Terrestrial Surveillance Locations at TTR

<i>On-Site Location</i>	<i>Revised Location Number</i>	<i>Old Location Number</i>	<i>Sample Location</i>	<i>Soil Sampling</i>	<i>Replicate</i>	<i>TLD</i>
Perimeter	P-05	T-05	O&M Complex - Site 4 Entrance Gate			√
	P-06	T-06	Cedar Pass Road Guard Station	√		√
	P-07	T-07	On-Base Housing - SW			√
	P-08	T-08	On-Base Housing (Main guard gate/ power pole CP17)	√		√
	P-11	T-13	Cactus Springs (TLD south of P-35)	√	√	√
	P-12	T-12	TLD at "US Gov't Property" Sign	√		√
	P-34	OM-03	O&M Complex (Owan Drive post)	√		
	P-35	T-11	Cactus Springs (north fence post)	√		
	P-36	T-36	On-Base Housing (NE fence line)	√		
	P-37	T-37	On-Base Housing (guard station)	√		

NOTE: TLD = Thermoluminescent Dosimeter

TTR = Tonopah Test Range

O&M = Operations & Maintenance

*In addition to single samp□

- Gamma-emitting radionuclides** – Gamma spectroscopy is used to detect the emission of gamma radiation from radioactive materials. Radionuclide identification is possible by measuring the spectrum of gamma energies associated with a sample, since each radionuclide has a unique and consistent series of gamma emissions. Cesium-137 (Cs-137) is an example of a long-lived gamma emitter that is prevalent in the environment (as fallout from historical nuclear weapons testing). Other gamma-emitters of interest at TTR are Americium-241 (Am-241) and depleted uranium (DU) from past explosives testing.
- Plutonium** – Due to past explosive testing, plutonium is present in some limited areas of TTR. One of the indicators of the presence of weapons-grade plutonium is the radionuclide Am-241. Isotopic plutonium analysis is normally performed on any sample for which gamma spectroscopy identified Am-241 in concentrations greater than its minimum detectable activity (MDA).
- Uranium** – Uranium occurs naturally in soils and may also be present as a pollutant in the environment due to past testing conducted at TTR. Total uranium (U_{tot}) analysis is used to measure all uranium isotopes present in a sample. A high U_{tot} measurement may trigger an isotope-specific analysis to determine the possible source of uranium (i.e., natural, man-made, enriched, or depleted).
- External gamma radiation exposure rates** - Thermoluminescent Dosimeters (TLDs) are used to measure ambient gamma exposure rates. Several natural gamma radiation sources exist, including cosmic radiation and radioactive materials that exist in geologic materials at TTR. The TLD network was established to determine the regional gamma exposure rate due to natural sources and to determine the impact, if any, of Sandia Corporation's operations on these levels. The dosimeters are placed on aluminum poles at a height of approximately one meter, and are exchanged and measured quarterly (January, April, July, and October) at 20 on-site, perimeter and off-site locations.

Radiological Results

The results of the statistical analysis showed no on-site or perimeter location that was both higher than off-site and with an increasing trend (Priority-1). Overall summary statistics for all radiological results are presented in [Table 4-5](#). The following radiological analytes showed one location as Priority-2 (higher than off-site): Am-241, Cs-137, Total Uranium. The Priority-2 locations along with the associated summary statistics are listed in [Table 4-6](#). The following radiological analyte showed at least one location as Priority-3 (increasing trend): Cs-137 and Total Uranium. While this increasing trend is "statistically significant", it is not operationally significant (does not pose a safety and health threat to human health or the environment). [Table 4-7](#) lists the analytes and their associated summary statistics. It should be noted that plutonium-238 (Pu-238), Pu-239/240, U-235, and U-238 were considered as Priority-4 (not higher than off-site or no increasing trend).

TABLE 4-5. Summary Statistics for Soil Locations (all units in pCi/g unless otherwise noted)

Analyte	Location Class	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Am-241	On-site	105	0.138	0.014	0.555	-0.162	3.580
	Perimeter	40	-0.003	-0.001	0.038	-0.145	0.050
	Off-site	70	0.002	0.004	0.040	-0.147	0.065
Cs-137	On-site	105	0.281	0.301	0.196	0	0.886
	Perimeter	70	0.211	0.161	0.159	0.012	0.573
	Off-site	40	0.238	0.200	0.165	0	0.930
Pu-238	On-site	30	0.0153	0.0071	0.0196	-0.102	0.0823
	Perimeter	8	0.0068	0.0040	0.0088	0.0018	0.0280
	Off-site	14	0.0058	0.0049	0.0069	-0.002	0.0238
Pu-239/240	On-site	30	0.5368	0.1180	1.1302	0.0011	4.92
	Perimeter	8	0.0163	0.0122	0.0141	0.0014	0.0431
	Off-site	14	0.0115	0.0109	0.0095	-0.001	0.0319
U-235	On-site	105	0.115	0.107	0.069	-0.043	0.389
	Perimeter	40	0.097	0.083	0.059	0.017	0.252
	Off-site	70	0.097	0.083	0.062	-0.005	0.293
U-238	On-site	105	1.477	1.520	0.556	0.315	3.13
	Perimeter	40	1.363	1.335	0.608	0.048	2.65
	Off-site	70	1.481	1.450	0.591	0.178	2.96
Total Uranium (µg/g)	On-site	105	0.709	0.704	0.134	0.426	1.09
	Perimeter	40	0.705	0.677	0.184	0.483	1.49
	Off-site	70	0.740	0.691	0.200	0.463	1.44

NOTE: Historical summary of all data for all locations and time (pooled)

The respective radiological analytes are discussed in the sections below listing the locations showing either Priority-2 or Priority-3.

Am-241

One on-site location (S-09) continues to be identified as Priority-2 (higher than off-site). S-09 is located near the Roller Coaster Decon site. The maximum result for this location was recorded in 2000 and is 3.58 pCi/g. No other on-site locations were identified as Priority-2. No perimeter location was identified as Priority-2 or Priority-3 (increasing trend).

Cs-137

One on-site location (S-50) continues to be identified as Priority-2 (higher than off-site). S-50 is located near the N/S Mellan Airstrip. The maximum value for Cs-137 was observed in 2003 at 0.767 pCi/g.

One on-site location (S-44) and one perimeter location (P-06) were identified as Priority-3 (increasing trend) for Cs-137. S-44 is located near the northeast corner of the TTR Operations Center for Sandia Corporation. P-06 is located at the Cedar Pass Road Guard Station. The maximum value observed for S-44 was 0.175 pCi/g while the maximum value for P-06 was 0.221 pCi/g.

Total Uranium (U_{tot})

There was one perimeter location (P-35) that was identified as Priority-2 (higher than off-site). The

maximum value observed at this location was 1.49 µg/g. P-35 is located at Cactus Springs northeast north fence post.

There were three on-site locations (S-09, S-10, and S-52) and one perimeter location (P-34) that were identified as Priority-3 (increasing trend). S-09 is located near the Roller Coaster Decon site. S-10 is located near the Brownes Road and Denton Freeway. S-52 is located northeast of the NW/SE Mellan Airstrip. P-34 is located at the Owan Drive post near the O&M Complex. The maximum value from these four locations was noted to be 0.842 µg/g and was observed at S-52 during the 2004 sampling period.

TLD Results

Sampling for 2004 was conducted from January 2004 through January 2005. TLDs were missing (not recovered) at several locations during 2004; when a TLD location has a missing quarter the data is not included in the summary statistics. Summary statistics for the past five years are shown in [Table 4-8](#).

On-site and perimeter locations were statistically different from off-site locations; off-site locations are statistically lower than either on-site or perimeter locations. There also appears to be a statistical difference between years with 2004 having the highest recorded results; there appears to be a grouping between 2002 and 2003, which appear to

TABLE 4-6. Summary Statistics for Soil Locations Noted as Priority-2 (all units in pCi/g unless otherwise noted)

Analyte	Location	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Am-241	S-09	5	2.162	2.590	1.534	0.532	3.580
Cs-137	S-50	5	0.548	0.552	0.144	0.398	0.767
Total Uranium (µg/g)	P-35	5	1.069	1.010	0.261	0.798	1.490

TABLE 4-7. Summary Statistics for Soil Locations Noted as Priority-3 (all units in pCi/g unless otherwise noted)

Analyte	Location	Sample Size	Average	Median	Std Dev	Minimum	Maximum
Cs-137	S-44	5	0.082	0.065	0.057	0.033	0.175
	P-06	5	0.155	0.0140	0.042	0.113	0.221
Total Uranium (µg/g)	S-09	5	0.606	0.612	0.042	0.543	0.648
	S-10	5	0.764	0.786	0.065	0.661	0.831
	S-52	5	0.752	0.786	0.108	0.579	0.842
	P-34	5	0.683	0.760	0.136	0.519	0.820

TABLE 4-8. Summary Statistics for TLDs by Location Class (all units in mrem unless otherwise noted)

Location Class	Sample Size	Average	Median	Std Dev	Minimum	Maximum
On-site	58	153.6	151.2	14.7	125.4	191.7
Perimeter	17	149.2	151.7	17.2	100.0	173.8
Off-site	16	139.5	143.3	15.2	105.1	163.2

be statistically greater than the grouping between 2000 and 2001. [Figure 4-1](#) graphically portrays the TLD results from 2000 through 2004. TLD results and TLD measurements by quarter and location type for 2004 are show in [Tables A-7 and A-8](#) of Appendix A, respectively.

4.1.6 Non-Radiological Parameters and Results

No non-radiological samples were collected in 2004.

4.2 WATER MONITORING

Results for potable water, wastewater effluent sampling, and the issue of storm water monitoring are discussed in this section.

The *Water Conservation Plan for the Tonopah Test Range* complies with State Water Resources Division regulations requiring a water conservation plan for permitted water systems and major water users in Nevada ([DOE 1992](#)).

4.2.1 Production Well Monitoring

There are three active wells used by Sandia Corporation at TTR. Production Well 6, Well 7, and the Roller Coaster Well. Production Well 6 and the Roller Coaster Well are the most active. Production Well 6, which supplies drinking water to the Sandia Corporation Main Compound in Area 3, is the only well that has been sampled for contaminants. Outlying areas use bottled water. The other wells are not used for potable purposes (construction and dust suppression) and there is no regulatory sampling requirement.

All sampling is conducted in accordance with requirements set by the state ([State of Nevada 1997](#)). Analytes are sampled at different intervals, as shown in [Table 4-9](#).

Sampled parameters included, but were not limited to, total coliforms, nitrates, nitrites, volatile organic compounds (VOCs), lead, copper, and arsenic.

Sandia Corporation remained in compliance with all Well 6 permit requirements in 2004 with one exception: samples for Disinfectant Byproduct

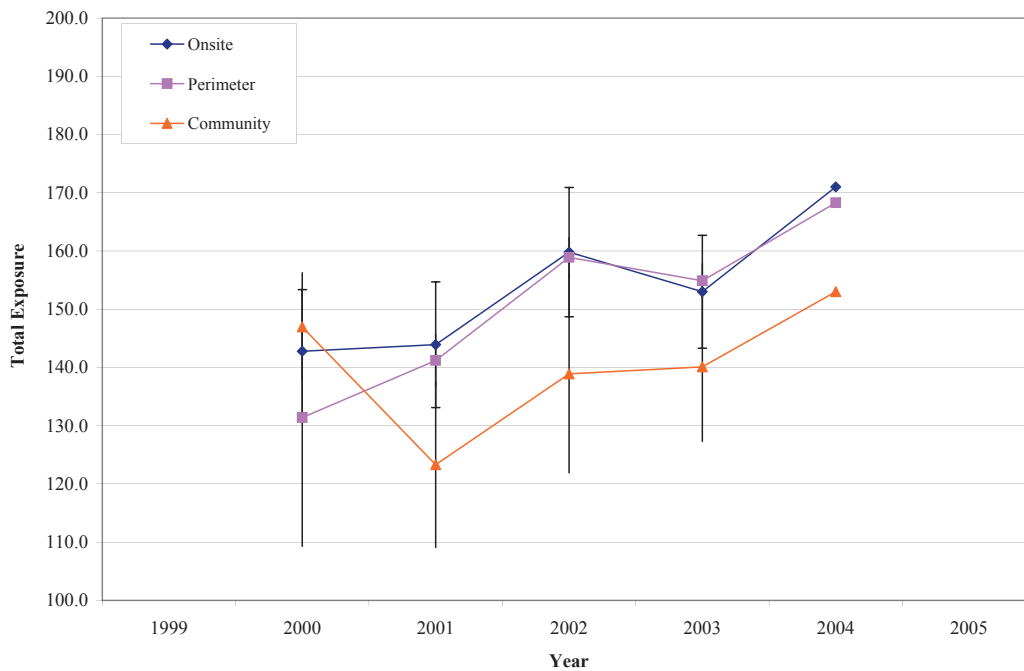


FIGURE 4-1. Tonopah Test Range TLD Exposure (1999-2004)

Monitoring (Trihalomethanes and Haloacetic Acids were required to be collected in July 2004 and was overlooked until October 2004). The state was immediately notified and TTR is awaiting a decision of any corrective action required.

In 2004, work continued on upgrading the TTR Area III Water System (The TTR Water and Fire Protection Project). Additional sampling was accomplished to determine specific treatment options for removal of arsenic and potential treatment to secondary standard SDWA requirements. As of this time, contracts have been let and work will proceed in January of 2005.

4.2.2 Sewage System and Septic Tank Monitoring

Sewage from Sandia Corporation's facilities in the Main Compound at Area 3 goes to the USAF facultative sewage lagoon. Either SNL/NM or Westinghouse Government Service takes annual wastewater samples from Area 3 at the point wastewater leaves Sandia Corporation property and enters the USAF system.

The USAF holds the NPDES permit for its wastewater discharges. The USAF takes quarterly samples from the headwater end of the lagoon. In the past, Sandia Corporation provided quarterly sampling results to the USAF for inclusion into their USAF Discharge Monitoring Report (DMR); however, the NPDES permit was modified in 1997

and no longer stipulates the requirement of quarterly data from Sandia Corporation. Therefore, Sandia Corporation now only provides annual sample results to the USAF.

Forty eight hour composite wastewater samples are collected on an annual basis and have the following parameters analyzed:

- Total coliforms;
- Total cyanide (Sandia Corporation does not use cyanide-containing compounds at TTR);
- pH (potential of hydrogen [acidity]) and non-filtered residue;
- Phenolics (Sandia Corporation does not use phenol-containing compounds at TTR);
- Chemical oxygen demand (COD);
- VOCs;
- Semi-Volatile Organic Compounds (SVOCs);
- Metals (cadmium, chromium, copper, nickel, silver, zinc, lead, selenium, and mercury);
- Total recoverable petroleum hydrocarbons (TRPH);
- Oil and grease; and

- Tritium, gamma spectroscopy, gross alpha, and gross beta.

All analytical results for wastewater sampled at Area 3 were within regulatory limits in 2004.

Septic Tank Systems

Septic tank systems are sampled, as needed. There are six septic systems located on-site, which are owned by Sandia Corporation at TTR. These six active septic tanks are used in remote locations and are maintained by the TTR facilities group. The sewage from these locations flows into septic tanks and associated drain fields. None of these systems required maintenance, sampling, or pumping in 2004. All other remaining septic systems have been closed or are undergoing closure and are being addressed by the ER Project.

4.2.3 Storm Water Monitoring

Currently, Sandia Corporation has no requirement to perform storm water monitoring at TTR. All storm water issues and monitoring are managed by the USAF.

4.3 RADIOLOGICAL AIR MONITORING

Air quality compliance at the TTR is met by adherence to specific permit conditions and compliance with local, state, and federal air regulations. Ambient air quality monitoring is not currently required at TTR. Ambient air monitoring was last conducted in 1996 to ascertain the level of radiological constituents in the air as discussed below.

Operations by Sandia Corporation at TTR do not involve activities that release radioactive emissions from either point sources (stacks and vents) or diffuse sources such as outdoor testing. However, diffuse radiological emissions are produced from the re-suspension of americium and plutonium present at the Clean Slate ER sites. Other ER sites with minor radiological contamination, such as DU, do not produce significant air emission sources from re-suspension.

National Emission Standards for Hazardous Air Pollutants (NESHAP)

NESHAP, 40 CFR 61, Subpart H, “National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities,” has set a maximum of 10 mrem/yr for all combined air emission pathway sources from any DOE/NNSA facility. Although the dose calculated from the Clean Slate sites is many times less than this standard, there was a question of whether the site would require continuous radiological air monitoring.

The 1995 NESHAP report for TTR reported a calculated effective dose equivalent (EDE) to the maximally exposed individual (MEI) of 1.1 mrem/yr as a result of diffuse emissions from the Clean Slate sites (SNL 1996). Because the EPA requires continuous air monitoring for any radionuclide source that contributes a dose in excess of 0.1 mrem/yr to the MEI, Sandia Corporation instituted continuous air monitoring at the site for one year, from February 22, 1996 to February 25, 1997. The monitoring site was chosen at the TTR Airport, the location of the highest calculated dose for a member

TABLE 4-9. Production Well Monitoring at TTR

Analyte	Sampling Frequency
Total Coliform	Monthly
Nitrate, Secondary (13) Drinking Water Standards	2003
Dioxin, Nitrate, Total Trihalomethanes/Haloacetic Acids (5)	2004
Arsenic, IOC's Phase II, IOC's Phase V, Nitrate, Nitrite Nitrate and Nitrite (Total), SOC's Phase II, SOC's Phase V Total Trihalomethanes/Haloacetic Acids (5), VOC's Phase I and II, VOC's Phase V,	2005
Asbestos, Lead/Copper, Nitrate, Secondary (13) Drinking Water Standards Total Trihalomethanes/Haloacetic Acids (5)	2006
Dioxin, Nitrate	2007
Arsenic, IOC's Phase II, IOC's Phase V, Nitrate, Nitrite, Nitrate and Nitrite (Total) SOC's Phase II, SOC's Phase V, VOC's Phase I and II, VOC's Phase V	2008
Lead/Copper, Nitrate, Secondary (13) Drinking Water Standards	2009
Dioxin, Nitrate	2010

NOTE: IOC = inorganic compounds
VOC = volatile organic compounds
SOC = synthetic organic compounds

TABLE 4-10. Calculated Dose Assessment Results for On-site Receptor

Dose to Receptor	Location	1997 Measured Dose*	NESHAP Standard	Natural Background
On-site Receptor (EDE to the MEI)	Airport TTR Area	0.024 mrem/yr (0.00024 mSv/yr)	10 mrem/yr (0.1 mSv/yr)	250 mrem/yr ¹

NOTE: *Dose calculated from continuous monitoring February 1996 to February 1997.

EDE = effective dose equivalent

MEI = maximally exposed individual

mrem/yr = millirem per year

mSv/yr = millisievert per year

TTR = Tonopah Test Range

¹ Natural background is estimated at 250 mrem/yr nationwide.

of the public. This site selection is discussed in the 1996 NESHAP report (SNL 1997). The dose assessment result from the continuous monitoring was 0.024 mrem/yr. This was about four times less than the 0.1 mrem/yr threshold cutoff for which continuous monitoring would be required by the EPA. The average air concentration in curies per cubic meter (Ci/m³) were measured as follows:

Am-241	4.1 x 10 ⁻¹⁸ Ci/m ³
Pu-238	1.6 x 10 ⁻¹⁸ Ci/m ³
Pu-239/240	9.5 x 10 ⁻¹⁹ Ci/m ³

Although an annual calculated dose assessment is not required for the site, Sandia Corporation continues to produce an annual NESHAP report for TTR (SNL 2005). The results from the 1996 to 1997 monitoring will continue to be used for as long as there is no change in the status of the Clean Slate sites. Table 4-10 summarizes these dose assessment results. Future TTR activities are not expected to change; however, if new sources or modifications to the existing sources are anticipated, they will be evaluated for NESHAP applicability.

4.4 NON-RADIOLOGICAL AIR EMISSIONS

The TTR Class II Air Quality Operating Permit Renewal in 2002 exempted most emission sources used at TTR with the exception of the screening plant and portable screen. In 2004, the total emissions reported to the State of Nevada were 0.002 ton per year from the portable screen. The screening plant was not used.

chapter five

2004 ANNUAL SITE ENVIRONMENTAL REPORT FOR THE KAUAI TEST FACILITY

In This Chapter ...

Facilities and Operations
2004 Rocket Launches
Demographics
Compliance Summary
Environmental Program Activities
Environmental Surveillance &
Monitoring Activities

Environmental Snapshot

The Sandia National Laboratories, Kauai Test Facility (SNL/KTF) has been an active rocket-launching facility since 1962. The site is primarily used for testing rocket systems. Nuclear devices have never been launched from SNL/KTF, nor have radiological materials been used at SNL/KTF.



Mountain Range in Kauai

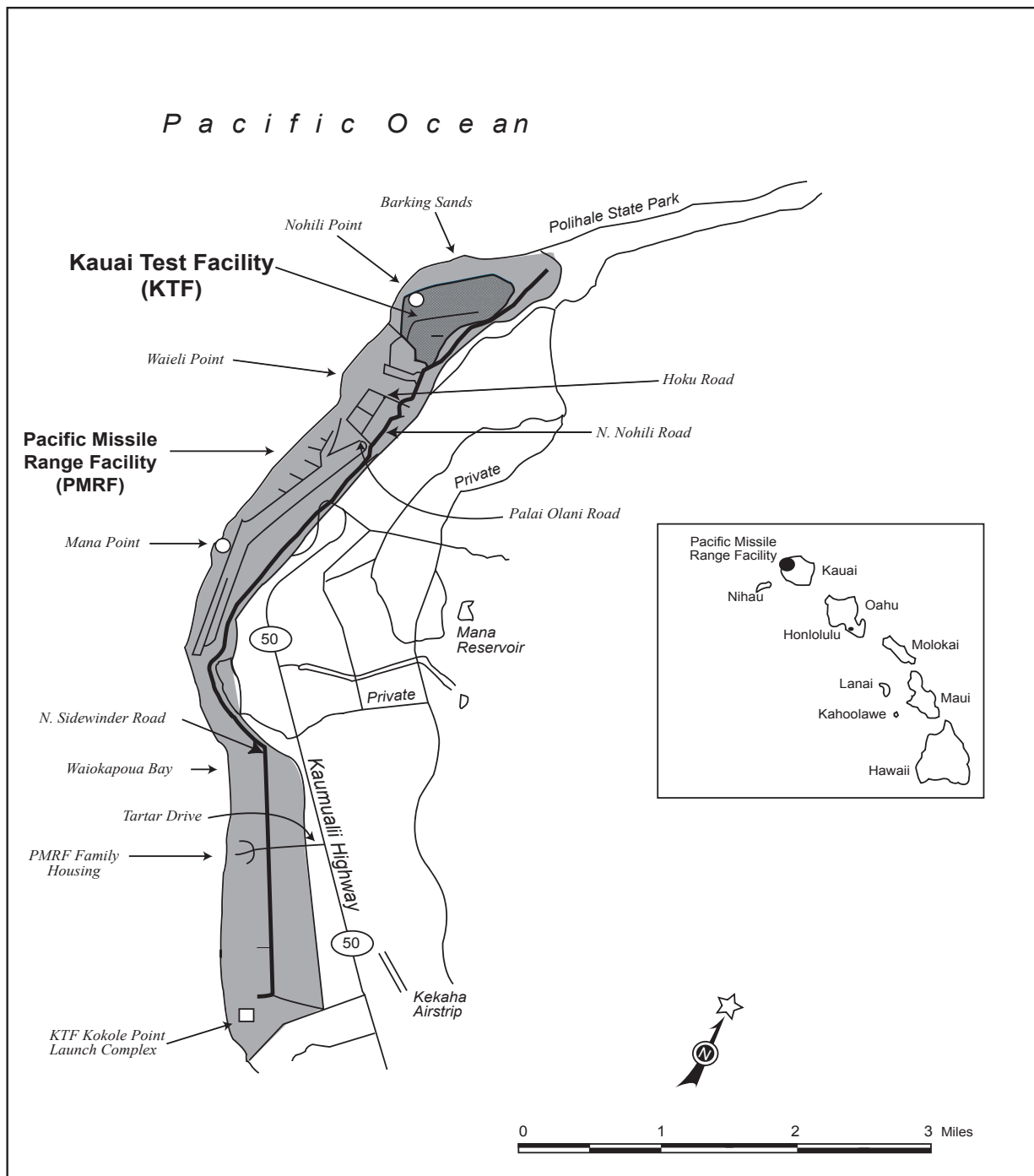


FIGURE 5-1. Map of the Pacific Missile Range Facility (PMRF) and the Adjacent Area (The Kauai Test Facility (KTF) is to the north, near Nohili Point)

The Kauai Test Facility (KTF) is operated by Sandia Corporation as a rocket preparation, launching, and tracking facility for the U.S. Department of Energy (DOE), National Nuclear Security Administration (NNSA), as well as in support of other U.S. military agencies. Sandia National Laboratories, Kauai Test Facility (SNL/KTF) refers to the facilities at KTF. SNL/KTF is owned by the DOE/NNSA and managed by the Sandia Site Office (SSO) in Albuquerque, New Mexico. SNL/KTF exists as a facility within the boundaries of the U.S. Department of Defense (DoD) Pacific Missile Range Facility (PMRF). SNL/KTF is located on the island of Kauai at the north end of the PMRF, near Nohili Point (Figure 5-1). This Annual Site Environmental Report (ASER) summarizes data and the compliance status of the environmental protection and monitoring programs at SNL/KTF for calendar year (CY) 2004. This report was prepared in accordance with DOE Order 450.1, *Environmental Protection Program* (DOE 2005) and DOE Order 231.1A, *Environment, Safety, and Health Reporting* (DOE 2004b).

5.1 FACILITIES AND OPERATIONS

SNL/KTF has been an active rocket-launching facility since 1962. The KTF and Remote Range Interfaces Department, under Sandia Corporation, manages and conducts the rocket-launching activities at SNL/KTF. The site is primarily used for testing rocket systems with scientific and technological payloads, advanced development of maneuvering re-entry vehicles, scientific studies of atmospheric and exoatmospheric phenomena, and Missile Defense Agency programs. Nuclear devices have never been launched from SNL/KTF, nor have radiological materials been used at SNL/KTF.

The first facilities at KTF were constructed in the early 1960s to support the National Readiness Program. The most recent construction, completed in 1994, added four buildings to support DOE and Strategic Defense Initiative (SDI) launches. From 1992 to 2004, there have been 20 launches.

The KTF launcher field was originally designed to accommodate 40 launch pads, but only 15 pads were constructed. Of these, 11 have had their launchers removed. Beyond the implementation of portions of the original plan, two additional launch pads were constructed: Pad 41 at Kokole Point, and Pad 42, the Strategic Targeting System (STARS) launch pad. The

KTF ASER

launcher field site has a number of permanent facilities used to support rocket operations. In addition to rocket launch pad sites, SNL/KTF facilities include missile assembly areas, data acquisition and operations facilities, a maintenance shop, and a trailer compound for administration and technical support personnel. Other features at SNL/KTF include extensive radar tracking and worldwide radio communication access to other DoD facilities.

The administrative area of SNL/KTF, known as the Main Compound, is located within a fenced area near the North Nohili access road from PMRF. Inside the fenced compound, a number of trailers and vans are connected together with a network of concrete docks and covered walkways. The majority of these temporary facilities are used during operational periods to support the field staff at SNL/KTF. During non-operational periods, general maintenance continues and dehumidifiers remain in operation (to protect equipment). Additionally, there are a number of permanent buildings, most of which are in use year-round to support and maintain SNL/KTF facilities.

5.2 2004 ROCKET LAUNCHES

There were no rockets launched from SNL/KTF in 2004.

5.3 DEMOGRAPHICS

There are 13 permanent on-site personnel at SNL/KTF. During operational periods when rocket launches occur, an additional 15 to 130 persons from the U.S. mainland are brought to SNL/KTF (DOE 1992a). The closest population center to SNL/KTF is the town of Kekaha (population 3,300), which is eight miles from the site.

5.4 COMPLIANCE SUMMARY

The list of statutes on page 5-5 provides an overview of compliance status for Sandia Corporation's operations at SNL/KTF in 2004. Table 5-1 lists the applicable permits in place at SNL/KTF.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

CERCLA, also known as "Superfund," addresses areas of past spills and releases. SNL/KTF has no

TABLE 5-1. Permits in Place at SNL/KTF

Type	Permit Number	Date Issued	Expiration Date	Regulatory Agency
Non-covered Source Permit (NSP) (two stand-by diesel generators)	NSP 0429-01-N	April 30, 2004	April 29, 2009	State of Hawaii
Resource Conservation and Recovery Act (RCRA)	HI-0000-363309	Sept. 23, 1994	Not specified	EPA Region IX and Hawaii Dept. of Health
UST (2,500)	Not applicable	Sept. 13, 1991	Indefinite	EPA Region IX and Hawaii Dept. of Health

NOTE: In 1999, there was a change in reporting fuel through put from annual reporting to biannual reporting to the State of Hawaii.

SNL/KTF = Sandia National Laboratories, Kauai Test Facility

EPA = U.S. Environmental Protection Agency

UST = Underground Storage Tank

current Environmental Restoration (ER) areas located on-site.

The U.S. Environmental Protection Agency (EPA) designated ongoing oversight of SNL/KTF to the Hawaii Department of Health Hazard Evaluation and Emergency Response Office. The EPA recommended continued reevaluation for environmental contamination due to the launching facility. Rocket exhaust continues to be the main source of metals and other non-reportable air emission releases.

Superfund Amendments and Reauthorization Act (SARA)

SARA Title III requires chemical inventory information and threshold quantity reporting as directed by the Emergency Planning and Community Right-to-Know Act (EPCRA), Sections 311 and 312. All required information has been submitted to the State of Hawaii. There were no reportable releases at SNL/KTF under EPCRA or CERCLA in 2004. [Table 5-2](#) lists SARA Title III reporting requirements.

Resource Conservation and Recovery Act (RCRA)

In 1994, SNL/KTF reached “small quantity hazardous waste generator” status as defined by RCRA, and therefore, obtained an EPA Identification Number. However, the volume of waste generated in 2004 qualified SNL/KTF to maintain “conditionally exempt small quantity generator” status.

Federal Facility Compliance Act (FFCA)

The FFCA addresses the disposition of mixed waste (MW) at federal facilities. No radioactive waste of any kind has been generated or stored at SNL/KTF and, therefore, this statute is not applicable to the site.

National Environmental Policy Act (NEPA)

NEPA requires federal agencies and private entities that perform federally-sponsored projects to include environmental aspects in early project planning and decision-making. A major intent of the law is to ensure that federal agencies are aware of the potential environmental impacts associated with their operations and include this information in early project planning and decision-making. NEPA mandates that an agency’s decision process be open for public review. Additionally, if a proposed action is determined to have environmentally “significant” impacts, the agency must prepare an EA or an environmental impact statement (EIS) before an irretrievable commitment of resources or funding occurs. Although a major objective of NEPA is to preserve the environment for future generations, the law does not require an agency to select the proposed action alternative with the least environmental impacts. The DOE/NSA/SSO coordinates NEPA compliance at SNL/KTF with Sandia National Labs, New Mexico (SNL/NM).

Endangered Species Act (ESA)

The ESA applies to both private individuals and federal agencies. Federal agencies must ensure that any action authorized, funded, or carried out by them will not jeopardize the continued existence of a threatened or endangered species, or result in adverse modifications of its habitat. The ESA is addressed under the NEPA Program and Ecology Program. If potentially significant impacts to sensitive species or habitats are found as a result of the proposed action, an EA or an EIS must be prepared.

[Table 5-3](#) lists all threatened and endangered state and federal listed species occurring on the island of Kauai.

Major Environmental Regulations & Statutes Applicable to KTF

Clean Air Act (CAA) and CAA Amendments (CAAA)

Provides standards to protect the nation's air quality http://www.epa.gov/oar/oaq_caa.html

Clean Water Act (CWA)

Provides general water quality standards to protect the nation's water sources and byways
<http://www.epa.gov/region5/watercwa.htm>

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

Provides federal funding for cleanup of inactive waste sites on the National Priorities List (NPL) and mandates requirements for reportable releases of hazardous substances <http://www.epa.gov/region5/defs/html/cercla.htm>

Cultural resources acts

Includes various acts that protect archeological, historical, religious sites, and resources
http://water.usgs.gov/eap/env_guide/cultural.html

Endangered Species Act (ESA)

Provides special protection status for federally-listed endangered or threatened species
<http://www.epa.gov/region5/defs/html/esa.htm>

Executive Orders (EOs)

Several EOs provide specific protection for wetlands, floodplains, environmental justice in minority and low-income populations, and greening the government through leadership in environmental management
http://www.archives.gov/federal_register/executive_orders/disposition_tables.html

Federal Facility Compliance Act (FFCA)

Directs federal agencies regarding environmental compliance <http://tis.eh.doe.gov/oepa/laws/ffca.html>

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

Controls the distribution and use of various pesticides <http://www.epa.gov/region5/defs/html/fifra.htm>

Migratory Bird Treaty Act (MBTA) of 1918

Prevents the taking, killing, possession, transportation and importation of migratory birds, their eggs, parts, and nests <http://tis.eh.doe.gov/oepa/laws/mbta.html>

National Emission Standards for Hazardous Air Pollutants (NESHAP)

Specifies standards for radionuclide air emissions and other hazardous air releases under the CAA
<http://www.epa.gov/radiation/neshaps/>

National Environmental Policy Act (NEPA)

Requires federal agencies to review all proposed activities so as to include environmental aspects in agency decision-making <http://tis.eh.doe.gov/NEPA/>

Resource Conservation and Recovery Act (RCRA)

Mandates the management of solid and hazardous waste and certain materials stored in underground storage tanks (USTs) <http://www.epa.gov/region5/defs/html/rcra.htm>

Safe Drinking Water Act (SDWA)

Provides specific standards used for drinking water sources <http://www.epa.gov/safewater/sdwa/sdwa.html>

Superfund Amendments and Reauthorization Act (SARA)

SARA, Title III, also known as the Emergency Planning and Community-Right-to-Know Act (EPCRA), mandates communication standards for hazardous materials over a threshold amount that are stored or used in a community
<http://www.epa.gov/region5/defs/html/sara.htm>

Toxic Substance Control Act (TSCA)

Specifies rules for the manufacture, distribution, and disposal of specific toxic materials such as asbestos and polychlorinated biphenyls (PCBs) <http://www.epa.gov/compliance/civil/tasca/index.html>

TABLE 5-2. 2004 SARA Title III (or EPCRA) Reporting Requirements Applicable to SNL/KTF

Section	SARA Title III Section Title	Requires Reporting?		Description
		Yes	No	
302 - 303	Notification/ Plans	✓		Sandia Corporation submits an annual report listing chemical inventories above the reportable Threshold Planning Quantities listed in 40 CFR Part 355 Appendix B, location of the chemicals and emergency contacts. The report is prepared for the DOE/NNSA/SSO, which distributes it to the required entities.
304	Emergency Notification		✓	No RQ releases of an EHS, or as defined under CERCLA, occurred in 2004.
311-312	MSDSs/ Chemical Purchase Inventory Report	✓		There are two "Community Right-to-Know" reporting requirements: (a) SNL/KTF completes the EPA Tier II forms for all hazardous chemicals present at the facility at any one time in amounts equal to or greater than 10,000 lbs and for all EHSs present at the facility in an amount greater than or equal to 500 lbs or the Threshold Planning Quantity, whichever is lower; (b) SNL/KTF provides MSDSs for each chemical entry on a Tier II form unless it decides to comply with the EPA's alternative MSDS reporting, which is detailed in 40 CFR Part 370.21.
313	Toxic Chemical Release Forms		✓	Sandia Corporation is below the reporting threshold in 2004 for producing a TRI Report for SNL/KTF operations.

NOTE: MSDS = Material Safety Data Sheets (gives relevant chemical information)

EHS = extremely hazardous substance

TRI = Toxic Release Inventory

RQ = reportable quantity

SNL/KTF = Sandia National Laboratories, Kauai Test Facility

EPA = U.S. Environmental Protection Agency

DOE/NNSA/SSO = U.S. Department of Energy, National Nuclear Security Administration, Sandia Site Office

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act

SARA = Superfund Amendments and Reauthorization Act

EPCRA = Emergency Planning and Community Right-to-Know Act

Cultural Resources Acts

The three primary cultural resources acts applicable at SNL/KTF are as follows:

- National Historic Preservation Act (NHPA);
- Archaeological Resources Protection Act (ARPA); and
- American Indian Religious Freedom Act (AIRFA).

At SNL/KTF, cultural resources compliance is coordinated through the NEPA Program. Actions that could adversely affect cultural resources are initially analyzed in a NEPA Checklist.

Migratory Bird Treaty Act (MBTA) of 1918

The MBTA of 1918 implemented the 1916 Convention for the protection of migratory birds. The original statute implemented the agreement between the United States (U.S.) and Great Britain (for Canada) and later amendments implemented treaties between the U.S. and

Mexico, the U.S. and Japan, and the U.S. and Russia. In addition to the special consideration afforded to species listed as threatened and endangered, most birds are protected under the MBTA of 1918, as amended. At SNL/KTF, the MBTA is coordinated with NEPA compliance reviews and the Ecology Program.

Environmental Compliance Executive Orders (EOs)

The four primary EOs related to environmental compliance at SNL/KTF are as follows:

- EO 11990, *Protection of Wetlands*, as amended
- EO 11988, *Floodplain Management*, as amended
- EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, as amended

TABLE 5-3. Threatened and Endangered Species Potentially Occurring on SNL/KTF

Common Name	Scientific Name	Federal Status	State Status
Plants			
Liliwai	<i>Acaena exigua</i>	Endangered	Endangered
No common name	<i>Achyranthes mutica</i>	Endangered	Endangered
Mahoe	<i>Alectryon macrococcus</i>	Endangered	Endangered
Kuawawaenohu	<i>Alsinidendron lychnoides</i>	Endangered	Endangered
No common name	<i>Alsinidendron viscosum</i>	Endangered	Endangered
No common name	<i>Bonamia menziesii</i>	Endangered	Endangered
Olulu	<i>Brighamia insignis</i>	Endangered	Endangered
Uhiuhi	<i>Caesalpinia kavaense</i>	Endangered	Endangered
‘Awiwi	<i>Centaurium sebaeoides</i>	Endangered	Endangered
No common name	<i>Chamaesyce halemanui</i>	Endangered	Endangered
Pauoa	<i>Ctenitis squamigera</i>	Endangered	Endangered
Haha	<i>Cyanea asarifolia</i>	Endangered	Endangered
Haha	<i>Cyanea recta</i>	Threatened	Threatened
Haha	<i>Cyanea remyi</i>	Endangered	Endangered
Haha	<i>Cyanea undulata</i>	Endangered	Endangered
Pu’uka’a	<i>Cyperus trachysanthos</i>	Endangered	Endangered
Ha’iwale	<i>Cyrtandra limahuliensis</i>	Threatened	Threatened
Mapele	<i>Cyrtandra cyaneoides</i>	Endangered	Endangered
No common name	<i>Delissea rhytidosperra</i>	Endangered	Endangered
‘Oha	<i>Delissea rivularis</i>	Endangered	Endangered
Asplenium Leaved Diella	<i>Diellia erecta</i>	Endangered	Endangered
No common name	<i>Diellia pallida</i>	Endangered	Endangered
No common name	<i>Diplazium molokaiense</i>	Endangered	Endangered
Na’ena’e	<i>Dubautia pauciflora</i>	Endangered	Endangered
Na’ena’e	<i>Dubautia latifolia</i>	Endangered	Endangered
‘Akoko	<i>Euphorbia haeleleana</i>	Endangered	Endangered
Heau	<i>Exocarpos luteolus</i>	Endangered	Endangered
Mehamehame	<i>Flueggea neowawraea</i>	Endangered	Endangered
No common name	<i>Gouania meyenii</i>	Endangered	Endangered
Honohono	<i>Haplostachys haplostachya</i>	Endangered	Endangered
‘Awiwi	<i>Hedyotis cookiana</i>	Endangered	Endangered
Na Pali Beach Hedyotis	<i>Hedyotis st.-johnii</i>	Endangered	Endangered
No common name	<i>Hesperomannia lydgatei</i>	Endangered	Endangered
Kauai Hau Kuahiwi	<i>Hibiscadelphus distans</i>	Endangered	Endangered
Hau Kuahiwi	<i>Hibiscadelphus woodii</i>	Endangered	Endangered
Hibiscus, Clay’s	<i>Hibiscus clayi</i>	Endangered	Endangered
Koki’o ke’oke’o	<i>Hibiscus waimeae ssp. hanneriae</i>	Endangered	Endangered
Wawae’iole	<i>Huperzia mannii (Phlegmariurus mannii)</i>	Endangered	Endangered
Ischaemum, Hilo	<i>Ischaemum byrone</i>	Endangered	Endangered
Aupaka	<i>Isodendron laurifolium</i>	Endangered	Endangered
Aupaka	<i>Isodendron longifolium</i>	Threatened	Threatened
Koki’o	<i>Kokia kauaiensis</i>	Endangered	Endangered

TABLE 5-3. Threatened and Endangered Species Potentially Occurring on SNL/KTF (continued)

Common Name	Scientific Name	Federal Status	State Status
Kamakahala	<i>Labordia lydgatei</i>	Endangered	Endangered
Kamakahala	<i>Labordia tinifolia</i> var. <i>wahiawaensis</i>	Endangered	Endangered
Nehe	<i>Lipochaeta fauriei</i>	Endangered	Endangered
Nehe	<i>Lipochaeta micrantha</i>	Endangered	Endangered
Nehe	<i>Lipochaeta waimeaensis</i>	Endangered	Endangered
Wawae'iole	<i>Lycopodium nutans</i> (<i>Phlegmariurus nutans</i>)	Endangered	Endangered
No common name	<i>Lysimachia filifolia</i>	Endangered	Endangered
No common name	<i>Mariscus pennatifolius</i> ssp. <i>pennatifolius</i>	Endangered	Endangered
Alani	<i>Melicope haupuensis</i>	Endangered	Endangered
Alani	<i>Melicope knudsenii</i>	Endangered	Endangered
Alani	<i>Melicope pallida</i>	Endangered	Endangered
Alani	<i>Melicope quadrangularis</i>	Endangered	Endangered
No common name	<i>Munroidendron racemosum</i>	Endangered	Endangered
Kolea	<i>Myrsine linearifolia</i>	Threatened	Threatened
‘Aiea	<i>Nothoestrum peltatum</i>	Endangered	Endangered
Lau ‘ehu	<i>Panicum niuhauense</i>	Endangered	Endangered
Makou	<i>Peucedanum sandwicense</i>	Threatened	Threatened
No common name	<i>Phyllostegia glabra</i> var. <i>lanaiensis</i>	Endangered	Endangered
No common name	<i>Phyllostegia knudsenii</i>	Endangered	Endangered
No common name	<i>Phyllostegia waimeae</i>	Endangered	Endangered
No common name	<i>Phyllostegia wawrana</i>	Endangered	Endangered
No common name	<i>Platanthera holochila</i>	Endangered	Endangered
Mann’s Bluegrass	<i>Poa mannii</i>	Endangered	Endangered
Hawaiian Bluegrass	<i>Poa sandwicensis</i>	Endangered	Endangered
No common name	<i>Poa siphonoglossa</i>	Endangered	Endangered
Lo’ulu	<i>Pritchardia napaliensis</i>	Endangered	Endangered
Lo’ulu	<i>Pritchardia viscosa</i>	Endangered	Endangered
Kaulu	<i>Pteralyxia kauaiensis</i>	Endangered	Endangered
No common name	<i>Remya kauaiensis</i>	Endangered	Endangered
No common name	<i>Remya montgomeryi</i>	Endangered	Endangered
Dwarf Naupaka	<i>Scaevola coriacea</i>	Endangered	Endangered
Ma’oli’oli	<i>Schiedea apokremnos</i>	Endangered	Endangered
No common name	<i>Schiedea helleri</i>	Endangered	Endangered
No common name	<i>Schiedea kauaiensis</i>	Endangered	Endangered
No common name	<i>Schiedea membranacea</i>	Endangered	Endangered
No common name	<i>Schiedea nuttallii</i>	Endangered	Endangered
No common name	<i>Schiedea spergulina</i> var. <i>leiopoda</i>	Endangered	Endangered
No common name	<i>Schiedea spergulina</i> var. <i>spergulina</i>	Threatened	Threatened
Laulihilihi	<i>Schiedea stellarioides</i>	Endangered	Endangered
‘Ohai	<i>Sesbania tomentosa</i>	Endangered	Endangered
No common name	<i>Silene lanceolata</i>	Endangered	Endangered
Popolo Ku Mai	<i>Solanum incompletum</i>	Endangered	Endangered

TABLE 5-3. Threatened and Endangered Species Potentially Occurring on SNL/KTF (concluded)

Common Name	Scientific Name	Federal Status	State Status
Popolo 'aiakeakua	<i>Solanum sandwicense</i>	Endangered	Endangered
No common name	<i>Spermolepis hawaiiensis</i>	Endangered	Endangered
No common name	<i>Stenogyne campanulata</i>	Endangered	Endangered
No common name	<i>Viola helenae</i>	Endangered	Endangered
Nani wai'ale'ale	<i>Viola kauaensis</i> var. <i>wahiawaensis</i>	Endangered	Endangered
Iliau, Dwarf	<i>Wilkesia hobdyi</i>	Endangered	Endangered
No common name	<i>Xylosma crenatum</i>	Endangered	Endangered
A'e	<i>Zanthoxylum dipetalum</i>	Endangered	Endangered
A'e	<i>Zanthoxylum hawaiiense</i>	Endangered	Endangered
ANIMALS			
Mammals			
Hawaiian Hoary Bat	<i>Lasiurus cinereus semotus</i>	Endangered	Endangered
Hawaiian Monk Seal	<i>Monachus schauinslandi</i>	Endangered	Endangered
Birds			
Hawaiian Duck	<i>Anas wyvilliana</i>	Endangered	Endangered
Hawaiian Coot	<i>Fulica americana alai</i>	Endangered	Endangered
Hawaiian Gallinule	<i>Gallinula chloropus sandwicensis</i>	Endangered	Endangered
Kauai Nuku pu'u	<i>Hemignathus lucidus hanapepe</i>	Endangered	Endangered
Kauai 'Akia loa	<i>Hemignathus procerus</i>	Endangered	Endangered
Black-necked Stilt	<i>Himantopus mexicanus knudseni</i>	Endangered	Endangered
Kauai 'O'o	<i>Moho braccatus</i>	Endangered	Endangered
Large Kauai Thrush	<i>Myadestes myadestinus</i>	Endangered	Endangered
Small Kauai Solitaire	<i>Myadestes palmeri</i>	Endangered	Endangered
Hawaiian Goose	<i>Nesochen sandwicensis</i>	Endangered	Endangered
No common name	<i>Psittirostra psittacea</i>	Endangered	Endangered
Dark-rumped Petrel	<i>Pterodroma phaeopygia sandwichensis</i>	Endangered	Endangered
Newell's Shearwater	<i>Puffinus auricularis newelli</i>	Threatened	Threatened
Reptiles			
Loggerhead Sea Turtle (incidental in Hawaii)	<i>Caretta caretta</i>	Threatened	Threatened
Green Sea Turtle	<i>Chelonia mydas</i>	Threatened	Threatened
Leatherback Sea Turtle (incidental in Hawaii)	<i>Dermochelys coriacea</i>	Endangered	Endangered
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Endangered	Endangered
Snails			
Newcomb's Snail	<i>Erinna newcombi</i>	Threatened	Threatened
Arachnids			
Kauai Cave Wolf Spider	<i>Adelocosa anops</i>	Endangered	Endangered
Insects			
Blackburn's Sphinx Moth	<i>Manduca blackburni</i>	Endangered	Endangered
Kauai Pomace Fly	<i>Drosophila musaphila</i>	Proposed Endangered	Proposed Endangered
Crustaceans			
Kauai Cave Amphipod	<i>Spelaeorchestia koloana</i>	Endangered	Endangered

- EO 13148, *Greening the Government Through Leadership in Environmental Management*

Clean Air Act (CAA) and Clean Air Act Amendments (CAAA) of 1990

Ambient air quality is regulated by Hawaii Administrative Rules (HAR), Title 11, Chapter 59 under the jurisdiction of the Hawaii Department of Health, Clean Air Branch. Currently, there are no facilities at SNL/KTF that require federal air permits or compliance with the New Source Performance Standards (NSPS), “Prevention of Significant Deterioration (PSD),” or 40 CFR 61, “National Emission Standards for Hazardous Air Pollutants” (NESHAP). Within the boundaries of PMRF, no federal air emission permits are held either by DOE for SNL/KTF, or by DoD for PMRF. However, the two electrical generators at SNL/KTF are permitted for operation by the State of Hawaii under a “Noncovered Source Permit (NSP)” ([Hawaii Department of Health 2004](#)).

As required by the EPA, the 2004 Annual Fee and Monitoring Report (air emissions) was submitted to the State of Hawaii at the end of February 2005 ([SNL 2005b](#)). In 2004, the total usage reported to the State of Hawaii was 4,736 gallons of diesel fuel. Sandia Corporation was in compliance with all air quality regulations in 2004.

Rocket launches are mobile sources and do not require reporting of reportable quantity (RQ) releases.

Clean Water Act (CWA)

There were no compliance issues with respect to any state or federal water pollution regulations in 2004. There are three septic tanks on-site owned by SNL/KTF facilities, which currently do not require permits from the State of Hawaii.

A National Pollutant Discharge Elimination System (NPDES) permit is not required due to the lack of significant storm water runoff discharging into “Waters of the U.S.,” as defined in 40 CFR 122. However, this is not to say that there is no runoff. The EPA has concern with storm water runoff washing off the launcher pads and discharging to the ocean. Some of the downstream pathways include habitat for several federally-designated endangered or threatened species. The EPA has therefore recommended periodic evaluations for environmental contamination.

Oil Storage – There is one underground storage tank (UST) at SNL/KTF, which is owned by the DOE. There is also one 10,000-gallon above ground fuel tank inside the Main Compound. Sandia Corporation cooperates with the U.S. Navy’s spill control guidelines contained in the Spill Prevention Control and Countermeasures (SPCC) Plan, Pacific Missile Range Facility ([NFEC 2003](#)).

Safe Drinking Water Act (SDWA)

The SDWA does not apply directly to Sandia Corporation activities at SNL/KTF because all drinking water is obtained through PMRF’s facilities or is purchased from commercial suppliers.

Toxic Substances Control Act (TSCA)

TSCA regulates the distribution of polychlorinated biphenyls (PCBs) and asbestos. The transformers on the SNL/KTF site have been tested and are free of PCBs, and there are no asbestos issues at the site.

Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)

FIFRA controls the distribution and application of pesticides including herbicides, insecticides, and rodenticides. All pesticide use at SNL/KTF follows EPA requirements.

Releases and Occurrences

There were no reportable occurrences at SNL/KTF in 2004.

5.5 ENVIRONMENTAL PROGRAM ACTIVITIES

This section describes three environmental programs: NEPA, the ER Project, and the Spill Prevention Program.

NEPA Program Activities

In accordance with NEPA, a comprehensive Site-wide EA was completed for SNL/KTF in 1992 ([DOE 1992a](#)), which resulted in a Finding of No Significant Impact (FONSI), issued on July 17, 1992. This EA is the current NEPA document covering all rocket-launching activities at SNL/KTF. Additionally, an EIS specific to the STARS Program is in place for rocket launches of this type ([DoD 1998](#)).

Prior to Sandia Corporation beginning any proposed action that may potentially affect sensitive species or habitats, a NEPA Checklist is submitted to DOE/NNSA/SSO for a determination. As it is applicable,

DOE/NNSA/SSO must consult with the following agencies:

- U.S. Fish and Wildlife Service
- State of Hawaii Department of Land and Natural Resources

In 2004, SNL/NM NEPA staff completed one NEPA compliance review for proposed actions at SNL/KTF. This review referenced existing NEPA documentation for KTF.

ER Project Activities

There are no ER sites at SNL/KTF. The three ER sites identified in 1995 were given a No Further Action (NFA) determination by the EPA on September 30, 1996. This confirmed that SNL/KTF met all CERCLA requirements and no additional sampling or remediation would be necessary in the three areas. This, however, does not preclude that other environmental sampling activities will take place at SNL/KTF.

5.6 ENVIRONMENTAL SURVEILLANCE AND MONITORING ACTIVITIES

Wastewater Monitoring

Sandia Corporation's activities at SNL/KTF produce only sanitary sewage, which is directed into five wastewater systems—three septic tanks and two French drains—in accordance with Hawaii Underground Injection Control regulations (HAR Title 11, Chapter 23). The septic systems are periodically pumped by licensed state-certified contractors and inspected by state officials. The limited quantity of sewage released does not impact any protected waters and, as noted earlier, there are no drinking water wells in the area of SNL/KTF. Currently, septic tanks do not require permitting or sampling. As a best management practice (BMP), Sandia Corporation periodically performs sampling. No contaminants were identified above the reporting limits from past sampling events.

Air Emission Monitoring

Based on effluent air monitoring results of the STARS Flight Test Unit 1 (FTU-1) in February 1993 and the CDX rocket launch in the summer of 1992 ([SNL 1992](#)), it was determined that rocket launches at SNL/KTF were not a significant source of air pollutants. Launches are infrequent and emissions recorded did

not exceed federal and state standards. Because the STARS type rocket produces the greatest air emissions and remained within acceptable limits, it can be assumed that future launches of this type will also be within acceptable limits. Therefore, no further air emission monitoring is planned at this time. If a new rocket type is launched from SNL/KTF that differs in emission substance from the STARS rocket, or air emission requirements change, future monitoring may be considered.

Meteorological Monitoring

On-site meteorological instruments are used during test periods to characterize atmospheric transport, diffusion conditions, and stability classes. Due to the infrequency of launches, no formal meteorological monitoring plan is in place for SNL/KTF. Climatic information representative of SNL/KTF is obtained from the PMRF.

Noise Monitoring

In accordance with the Quiet Communities Act of 1978 (42 U.S.C. 4901 et seq.), noise monitoring was conducted in February 1993 during the STARS FTU-1 launch to confirm the determination made in the STARS EIS that noise produced from the largest launch would be below maximum acceptable levels ([SNL 1993](#)). Data collected in the nearest town of Kekaha indicated that levels were no louder than noise generated from passing vehicles on a nearby highway.

Terrestrial Surveillance

Terrestrial surveillance sampling of soil is conducted every five years. No sampling occurred in 2004.

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chapter six

TTR & KTF REFERENCES

In This Chapter ...

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DOE Orders
Code of Federal
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Act and Statutes
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Kauai Test Facility Lighthouse at a distance

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- 40 CFR 110** "Discharge of Oil"
- 40 CFR 112** "Oil Pollution Prevention"
- 40 CFR 141.26** "Monitoring Frequency and Compliance Requirements for Radionuclides in Community Water Systems"

- 40 CFR 270** “EPA Administered Permit Programs: The Hazardous Waste Permit Program”
- 40 CFR 280** “Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks”
- 40 CFR 355** “Emergency Planning and Notification”
- 40 CFR 370** “Hazardous Chemical Reporting: Community Right-to-Know”
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STATE OF HAWAII ENVIRONMENTAL REGULATIONS

Hawaii Administrative Rules (HAR), Title 11, Chapter 23, “Underground Injection Control”

Hawaii Administrative Rules (HAR), Title 11, Chapter 59, “Ambient Air Quality Standards”

STATE OF NEVADA

ENVIRONMENTAL REGULATIONS

Nevada regulatory information can be found at the Nevada State Legislature website:
<http://www.leg.state.nv.us/>

A listing of the Nevada Administration Code (NAC) can be found at:
<http://www.leg.state.nv.us/NAC/CHAPTERS.html>

TABLE 6-1. State of Nevada Administrative Code (NAC) Applicable to the TTR

Chapter 444, Sanitation	Applicable Sources or Activities
NAC 444.570 to 444.7499, "Solid Waste Disposal"	<ul style="list-style-type: none"> • Disposal of construction debris • Disposal of routine non-hazardous solid wastes • Disposal of septic sludge
NAC 444A.005 to 444A.500, "Programs for Recycling"	<ul style="list-style-type: none"> • Recyclable materials including waste tires
Chapter 445A, Water Controls	
NAC 445A.070 to 445A.348, "Water Pollution Control"	<ul style="list-style-type: none"> • Septic tanks • Surface water runoff
NAC 445A.450 to 445A. 6731, "Public Water Systems"	<ul style="list-style-type: none"> • Production well sampling
Chapter 445B, Air Controls	
NAC 445B.001 to 445B.3497, "Air Pollution"	<ul style="list-style-type: none"> • Open burning • Hazardous air pollutants from stacks and vents • Disturbance of soils during construction (particulate matter)
NAC 445B.400 to 445B.774, "Emissions From Engines"	<ul style="list-style-type: none"> • Generators • Mobile sources
Chapter 504, Wildlife Management and Propagation*	
NAC 504.110 to 504.340, "Wildlife Management Areas"	<ul style="list-style-type: none"> • Road construction
NAC 504.510 to 504.550, "Alteration of Stream System or Watershed"	<ul style="list-style-type: none"> • Construction activities
NAC 504.800 to 504.865, "Preservation of Wild Horses"***	<ul style="list-style-type: none"> • General activities on the range in wild horse areas
Chapter 534, Underground Water and Wells	
NAC 534.010 to 534.450, "Underground Water and Wells"	<ul style="list-style-type: none"> • Drilling, operation, and abandonment of wells

NOTE: *This regulation provides protection to endangered, threatened, and sensitive species.

***Two wild horse units encompass areas within the Nellis Air Force Range:

"Unit 252: That portion of Nye County and those portions of the Nellis Air Force Range as authorized by the United States Department of Defense."

"Unit 253: That portion of Nye County ... including those portions of the Nellis Air Force Range as authorized by the United States Department of Defense and the Nevada Test Site as authorized by the United States Department of Energy." (NAC 504.21, "General Designation of Management Areas and Units")

TTR = Tonopah Test Range

APPENDIX A

TERRESTRIAL SURVEILLANCE RESULTS AND SAMPLING LOCATION MAPS FOR TTR



Wild Horses at TTR

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TABLE A-1. Radiological Results for Off-site Soil Sampling Locations at TTR, 2004

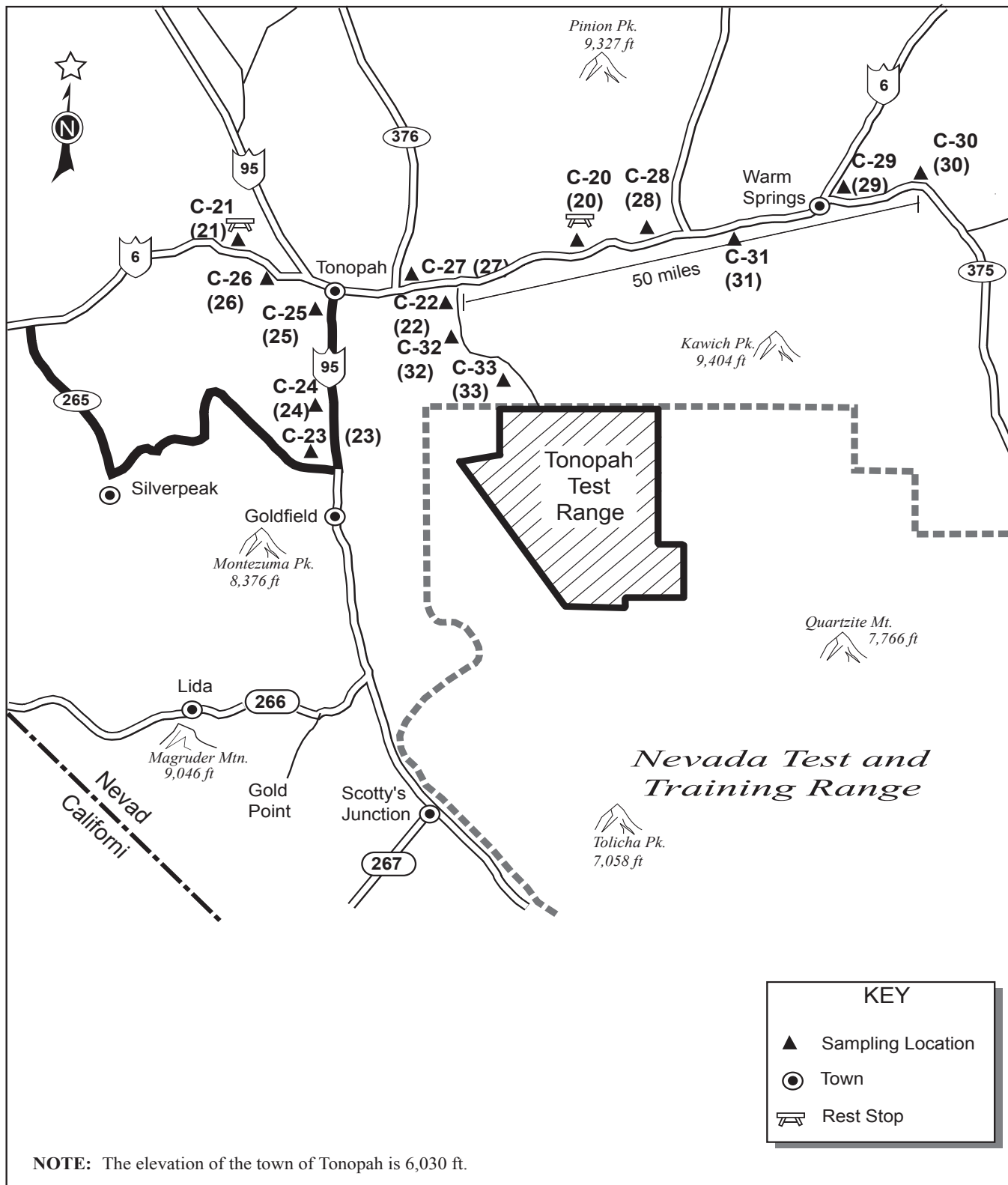
Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
C-20	Americium-241	pCi/g	0.0274 ± 0.0313	0.0305	0.0617	U
	Cesium-137	pCi/g	0.194 ± 0.0246	0.00741	0.0151	
	Potassium-40	pCi/g	27.8 ± 1.9	0.0647	0.134	
	Uranium-235	pCi/g	0.0861 ± 0.0829	0.0529	0.107	U
	Uranium-238	pCi/g	1.12 ± 0.505	0.253	0.511	
	Uranium	mg/kg	0.842	0.00592	0.0394	
C-21	Americium-241	pCi/g	0.0478 ± 0.036	0.0301	0.0607	UX
	Cesium-137	pCi/g	0.11 ± 0.0374	0.0137	0.028	
	Potassium-40	pCi/g	27.7 ± 1.87	0.109	0.229	
	Uranium-235	pCi/g	0.105 ± 0.1	0.0702	0.142	U
	Uranium-238	pCi/g	1.18 ± 0.553	0.272	0.55	
	Uranium	mg/kg	0.92	0.00589	0.0393	
C-22	Americium-241	pCi/g	0.0363 ± 0.0757	0.0681	0.138	U
	Cesium-137	pCi/g	0.0571 ± 0.0361	0.015	0.031	
	Potassium-40	pCi/g	29.4 ± 2.1	0.122	0.262	
	Uranium-235	pCi/g	0.00661 ± 0.123	0.0931	0.189	U
	Uranium-238	pCi/g	1.14 ± 0.874	0.548	1.11	
	Uranium	mg/kg	0.582	0.00593	0.0395	
C-23	Americium-241	pCi/g	-0.147 ± 0.104	0.0815	0.166	U
	Cesium-137	pCi/g	0.263 ± 0.0421	0.0127	0.0263	
	Potassium-40	pCi/g	25.5 ± 1.96	0.101	0.216	
	Uranium-235	pCi/g	0.0586 ± 0.117	0.0928	0.189	U
	Uranium-238	pCi/g	0.471 ± 0.981	0.654	1.33	U
	Uranium	mg/kg	0.638	0.00587	0.0391	
C-24	Americium-241	pCi/g	-0.00523 ± 0.0581	0.0556	0.113	U
	Cesium-137	pCi/g	0.192 ± 0.0357	0.0153	0.0317	
	Potassium-40	pCi/g	30.4 ± 2.2	0.115	0.246	
	Uranium-235	pCi/g	0.204 ± 0.163	0.0991	0.202	
	Uranium-238	pCi/g	1.32 ± 0.771	0.487	0.991	
	Uranium	mg/kg	0.742	0.00592	0.0394	
C-25	Americium-241	pCi/g	0.0377 ± 0.0465	0.0337	0.068	UX
	Cesium-137	pCi/g	0.117 ± 0.046	0.015	0.0307	
	Potassium-40	pCi/g	28.7 ± 1.96	0.12	0.252	
	Uranium-235	pCi/g	0.0406 ± 0.134	0.0792	0.16	U
	Uranium-238	pCi/g	1.19 ± 0.619	0.304	0.613	
	Uranium	mg/kg	1.07	0.00588	0.0392	
C-26	Americium-241	pCi/g	0.0354 ± 0.0827	0.0558	0.113	U
	Cesium-137	pCi/g	0.583 ± 0.0485	0.00858	0.0175	
	Potassium-40	pCi/g	30.5 ± 2.2	0.0721	0.15	
	Uranium-235	pCi/g	0.0811 ± 0.0852	0.0569	0.115	UX
	Uranium-238	pCi/g	0.987 ± 0.817	0.426	0.861	
	Uranium	mg/kg	0.832	0.006	0.04	
C-27	Americium-241	pCi/g	0.0414 ± 0.0565	0.0548	0.111	U
	Cesium-137	pCi/g	0.164 ± 0.0256	0.011	0.0226	
	Potassium-40	pCi/g	32.5 ± 2.17	0.0911	0.192	
	Uranium-235	pCi/g	0.0509 ± 0.095	0.0664	0.134	U
	Uranium-238	pCi/g	1.12 ± 0.695	0.434	0.879	
	Uranium	mg/kg	0.631	0.00592	0.0394	

See notes at end of table.

TABLE A-1. Radiological Results for Off-site Soil Sampling Locations at TTR, 2004 (concluded)

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
C-28	Americium-241	pCi/g	0.00976 ± 0.0433	0.0431	0.0874	U
	Cesium-137	pCi/g	0.103 ± 0.0181	0.00885	0.0182	
	Potassium-40	pCi/g	30 ± 1.98	0.0748	0.158	
	Uranium-235	pCi/g	0.0835 ± 0.101	0.0573	0.116	UX
	Uranium-238	pCi/g	0.796 ± 0.601	0.34	0.688	
	Uranium	mg/kg	0.705	0.00592	0.0394	
C-29	Americium-241	pCi/g	0.014 ± 0.0676	0.0619	0.125	U
	Cesium-137	pCi/g	0.112 ± 0.0187	0.00853	0.0176	
	Potassium-40	pCi/g	17.3 ± 1.31	0.0872	0.183	
	Uranium-235	pCi/g	0.156 ± 0.112	0.0637	0.129	
	Uranium-238	pCi/g	1.04 ± 0.868	0.475	0.962	
	Uranium	mg/kg	1.05	0.00594	0.0396	
C-30	Americium-241	pCi/g	0.0141 ± 0.0165	0.0148	0.0298	U
	Cesium-137	pCi/g	0.284 ± 0.0363	0.0103	0.0209	
	Potassium-40	pCi/g	29.4 ± 1.88	0.0841	0.174	
	Uranium-235	pCi/g	0.101 ± 0.0905	0.0537	0.108	U
	Uranium-238	pCi/g	0.545 ± 0.341	0.141	0.285	
	Uranium	mg/kg	0.601	0.00595	0.0397	
C-31	Americium-241	pCi/g	-0.0685 ± 0.0911	0.0843	0.171	U
	Cesium-137	pCi/g	0.208 ± 0.0314	0.0113	0.0233	
	Potassium-40	pCi/g	31.3 ± 2.27	0.0906	0.191	
	Uranium-235	pCi/g	0.0645 ± 0.0901	0.0752	0.152	U
	Uranium-238	pCi/g	0.898 ± 1.02	0.635	1.28	UX
	Uranium	mg/kg	0.877	0.00591	0.0394	
C-32	Americium-241	pCi/g	0.0248 ± 0.0754	0.0485	0.0981	U
	Cesium-137	pCi/g	0.144 ± 0.0212	0.00773	0.0158	
	Potassium-40	pCi/g	32.5 ± 2.34	0.0645	0.134	
	Uranium-235	pCi/g	0.0587 ± 0.0594	0.0551	0.111	UX
	Uranium-238	pCi/g	1.06 ± 0.648	0.401	0.81	
	Uranium	mg/kg	0.629	0.00596	0.0398	
C-33	Americium-241	pCi/g	-0.00359 ± 0.0565	0.0507	0.103	U
	Cesium-137	pCi/g	0.0892 ± 0.0202	0.0107	0.022	
	Potassium-40	pCi/g	29.4 ± 2.11	0.0909	0.192	
	Uranium-235	pCi/g	0.0255 ± 0.101	0.0635	0.129	U
	Uranium-238	pCi/g	0.56 ± 0.602	0.415	0.841	UX
	Uranium	mg/kg	0.676	0.00589	0.0393	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.
X = Presumptive evidence that analyte is not present.



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FIGURE A-1. Off-site Soil Sampling Locations
(14 Locations)

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TABLE A-2. Radiological Results for Perimeter Soil Sampling Locations at TTR, 2004

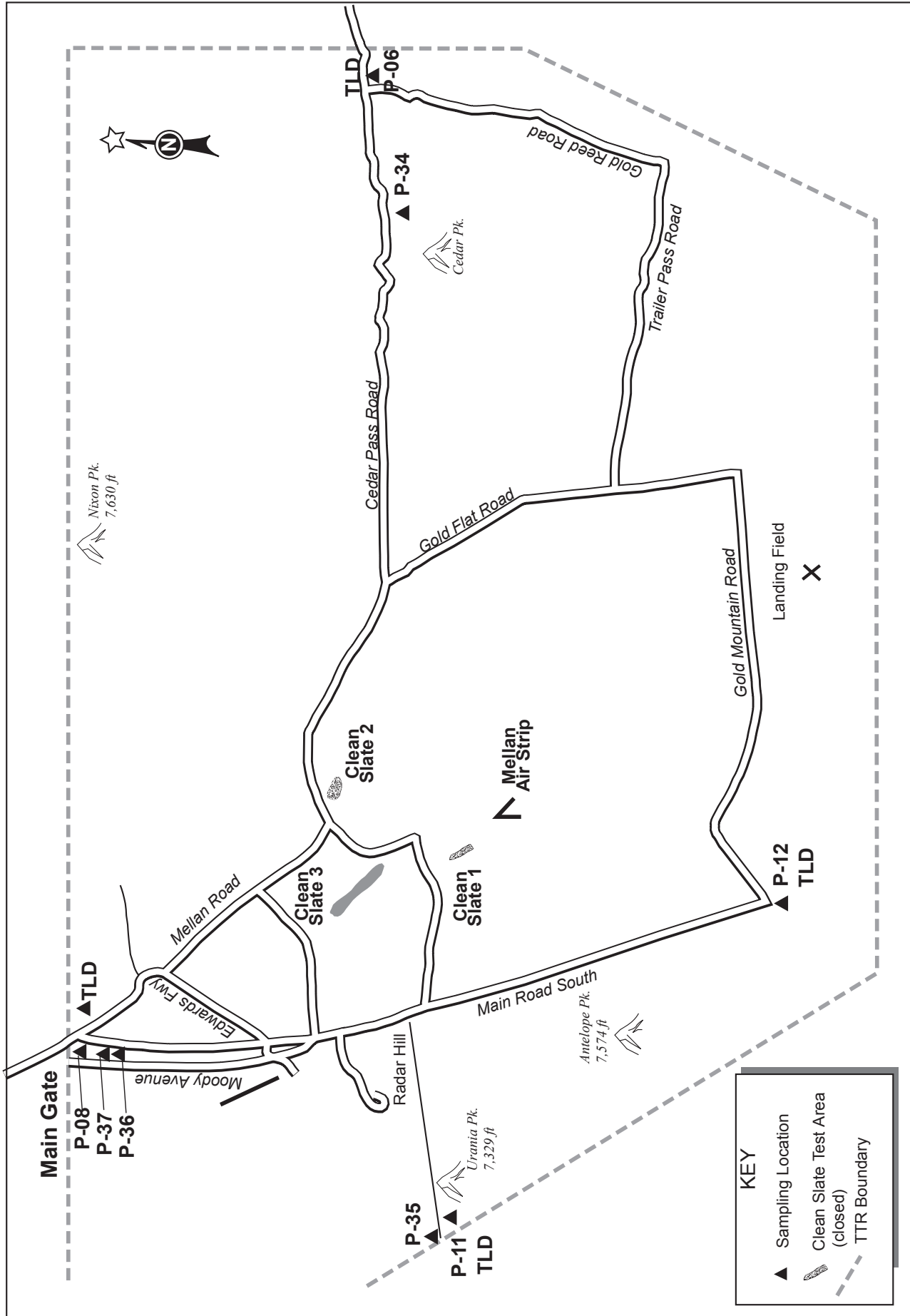
Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
P-06	Americium-241	pCi/g	0.0279 ± 0.0909	0.0825	0.168	U
	Cesium-137	pCi/g	0.221 ± 0.031	0.0131	0.027	
	Potassium-40	pCi/g	30.3 ± 2.26	0.111	0.236	
	Uranium-235	pCi/g	0.0688 ± 0.12	0.0788	0.16	U
	Uranium-238	pCi/g	1.25 ± 1.12	0.611	1.24	
	Uranium	mg/kg	0.668	0.00595	0.0397	
P-08	Americium-241	pCi/g	-0.00299 ± 0.0808	0.0692	0.141	U
	Cesium-137	pCi/g	0.0903 ± 0.028	0.0147	0.0306	
	Potassium-40	pCi/g	32 ± 2.47	0.118	0.255	
	Uranium-235	pCi/g	0.135 ± 0.148	0.0943	0.192	UX
	Uranium-238	pCi/g	0.965 ± 0.96	0.565	1.15	UX
	Uranium	mg/kg	0.635	0.00588	0.0392	
P-11	Americium-241	pCi/g	-0.0296 ± 0.0655	0.058	0.117	U
	Cesium-137	pCi/g	0.143 ± 0.0253	0.012	0.0247	
	Potassium-40	pCi/g	31 ± 2.08	0.0964	0.203	
	Uranium-235	pCi/g	0.143 ± 0.107	0.0706	0.143	
	Uranium-238	pCi/g	0.424 ± 0.776	0.481	0.973	U
	Uranium	mg/kg	0.582	0.00587	0.0391	
P-12	Americium-241	pCi/g	-0.016 ± 0.0528	0.0511	0.103	U
	Cesium-137	pCi/g	0.275 ± 0.0293	0.0114	0.0234	
	Potassium-40	pCi/g	33.4 ± 2.28	0.0952	0.2	
	Uranium-235	pCi/g	0.0755 ± 0.109	0.0725	0.147	U
	Uranium-238	pCi/g	1.36 ± 0.711	0.404	0.817	
	Uranium	mg/kg	0.589	0.00599	0.0399	
P-34	Americium-241	pCi/g	0.0304 ± 0.0421	0.0417	0.0843	U
	Cesium-137	pCi/g	0.325 ± 0.039	0.0107	0.0218	
	Potassium-40	pCi/g	33.6 ± 2.31	0.0805	0.168	
	Uranium-235	pCi/g	0.103 ± 0.0963	0.0695	0.141	U
	Uranium-238	pCi/g	0.903 ± 0.666	0.356	0.719	
	Uranium	mg/kg	0.76	0.00587	0.0391	
P-35	Americium-241	pCi/g	-0.00554 ± 0.0341	0.0324	0.0653	U
	Cesium-137	pCi/g	0.321 ± 0.0468	0.0137	0.028	
	Potassium-40	pCi/g	24.2 ± 1.65	0.104	0.218	
	Uranium-235	pCi/g	0.0451 ± 0.103	0.0751	0.152	U
	Uranium-238	pCi/g	0.747 ± 0.489	0.295	0.594	
	Uranium	mg/kg	1.49	0.00589	0.0393	
P-36	Americium-241	pCi/g	-0.0182 ± 0.0653	0.057	0.115	U
	Cesium-137	pCi/g	0.0922 ± 0.019	0.00956	0.0196	
	Potassium-40	pCi/g	31.6 ± 2.39	0.0815	0.171	
	Uranium-235	pCi/g	0.0342 ± 0.0861	0.0558	0.113	U
	Uranium-238	pCi/g	0.827 ± 0.724	0.441	0.892	U
	Uranium	mg/kg	0.737	0.00588	0.0392	

See notes at end of table.

TABLE A-2. Radiological Results for Perimeter Soil Sampling Locations at TTR, 2004 (concluded)

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
P-37	Americium-241	pCi/g	-0.00851 \pm 0.0682	0.062	0.126	U
	Cesium-137	pCi/g	0.0445 \pm 0.019	0.0115	0.0242	
	Potassium-40	pCi/g	30 \pm 2.18	0.135	0.288	
	Uranium-235	pCi/g	0.034 \pm 0.0845	0.0804	0.164	U
	Uranium-238	pCi/g	0.623 \pm 0.772	0.497	1.01	UX
	Uranium	mg/kg	0.746	0.00584	0.0389	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.
X = Presumptive evidence that analyte is not present.



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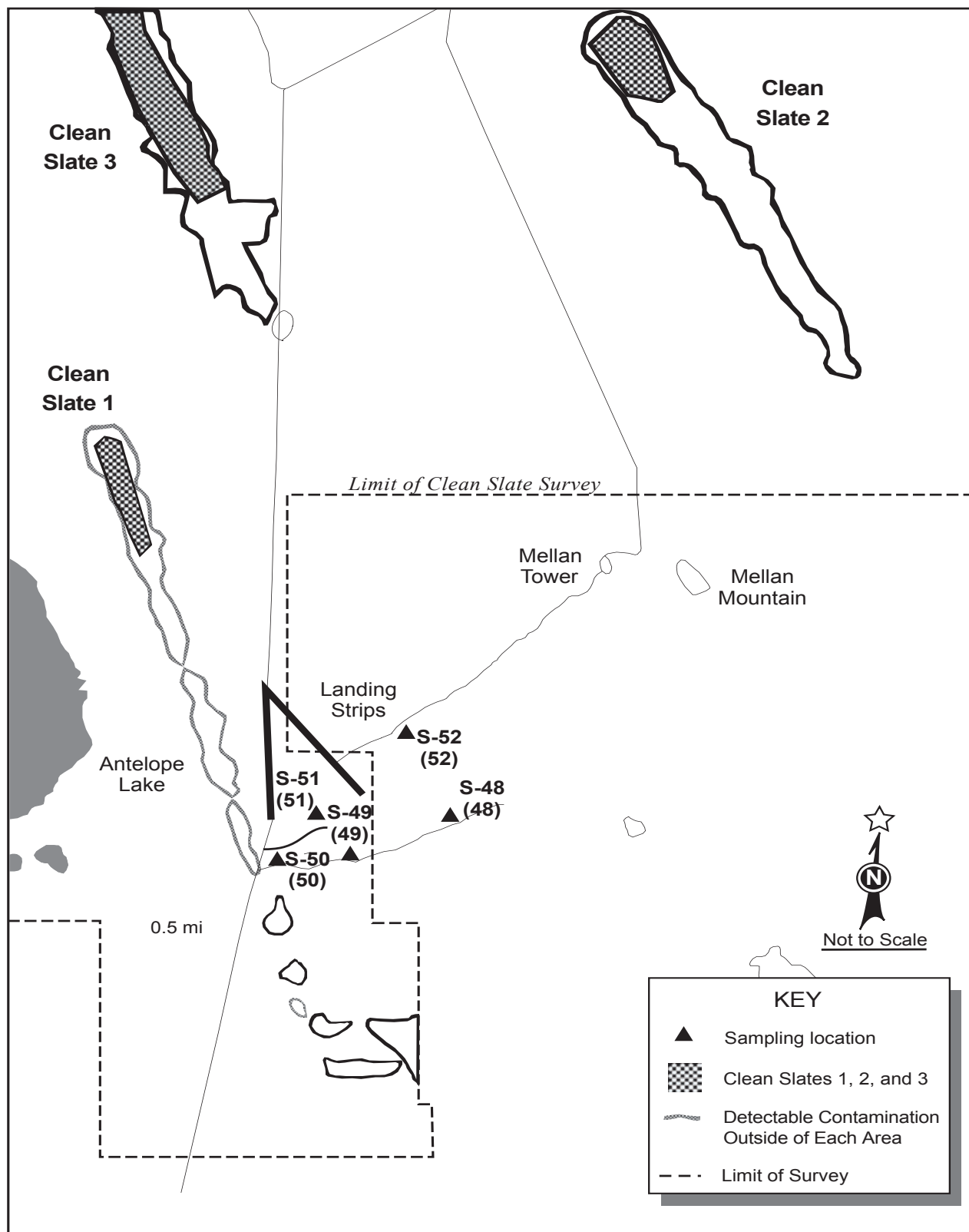
FIGURE A-2. Perimeter Soil Sampling Locations
(Eight Locations)

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TABLE A-3. Radiological Results for South Plume Area On-site Soil Sampling Locations at TTR, 2004

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-48	Americium-241	pCi/g	0.00119 ± 0.0394	0.0374	0.0756	U
	Cesium-137	pCi/g	0.428 ± 0.0591	0.0164	0.0336	
	Potassium-40	pCi/g	28.8 ± 1.98	0.12	0.254	
	Uranium-235	pCi/g	0.056 ± 0.0953	0.0861	0.174	U
	Uranium-238	pCi/g	0.785 ± 0.553	0.339	0.684	
	Uranium	mg/kg	0.509	0.00596	0.0398	
S-49	Americium-241	pCi/g	0.358 ± 0.0377	0.0188	0.038	
	Cesium-137	pCi/g	0.417 ± 0.0471	0.0126	0.0256	
	Potassium-40	pCi/g	32.1 ± 2.07	0.101	0.209	
	Uranium-235	pCi/g	0.0992 ± 0.07	0.0646	0.131	UX
	Uranium-238	pCi/g	1.35 ± 0.383	0.177	0.358	
	Uranium	mg/kg	0.743	0.006	0.04	
S-50	Americium-241	pCi/g	-0.000176 ± 0.0901	0.0744	0.151	U
	Cesium-137	pCi/g	0.398 ± 0.034	0.00946	0.0194	
	Potassium-40	pCi/g	31.7 ± 2.58	0.08	0.168	
	Uranium-235	pCi/g	0.00472 ± 0.0846	0.0639	0.129	U
	Uranium-238	pCi/g	1.39 ± 0.902	0.515	1.05	
	Uranium	mg/kg	0.62	0.00593	0.0395	
S-51	Americium-241	pCi/g	0.052 ± 0.0539	0.0468	0.0949	U
	Cesium-137	pCi/g	0.391 ± 0.0355	0.0106	0.0218	
	Potassium-40	pCi/g	29.9 ± 2.06	0.0958	0.201	
	Uranium-235	pCi/g	0.0874 ± 0.0964	0.0632	0.128	U
	Uranium-238	pCi/g	0.829 ± 0.675	0.387	0.783	
	Uranium	mg/kg	0.601	0.00594	0.0396	
S-52	Americium-241	pCi/g	0.22 ± 0.045	0.0187	0.0378	
	Cesium-137	pCi/g	0.335 ± 0.0403	0.0125	0.0257	
	Potassium-40	pCi/g	30.3 ± 1.94	0.101	0.214	
	Uranium-235	pCi/g	0.0361 ± 0.0986	0.064	0.13	U
	Uranium-238	pCi/g	0.904 ± 0.393	0.184	0.373	
	Uranium	mg/kg	0.786	0.006	0.04	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.
X = Presumptive evidence that analyte is not present.



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FIGURE A-3. Soil Sampling Locations in the South Plume Area (on-site) (Five Locations)

TABLE A-4. Radiological Results for Range Operations Center On-site Soil Sampling Locations at TTR, 2004

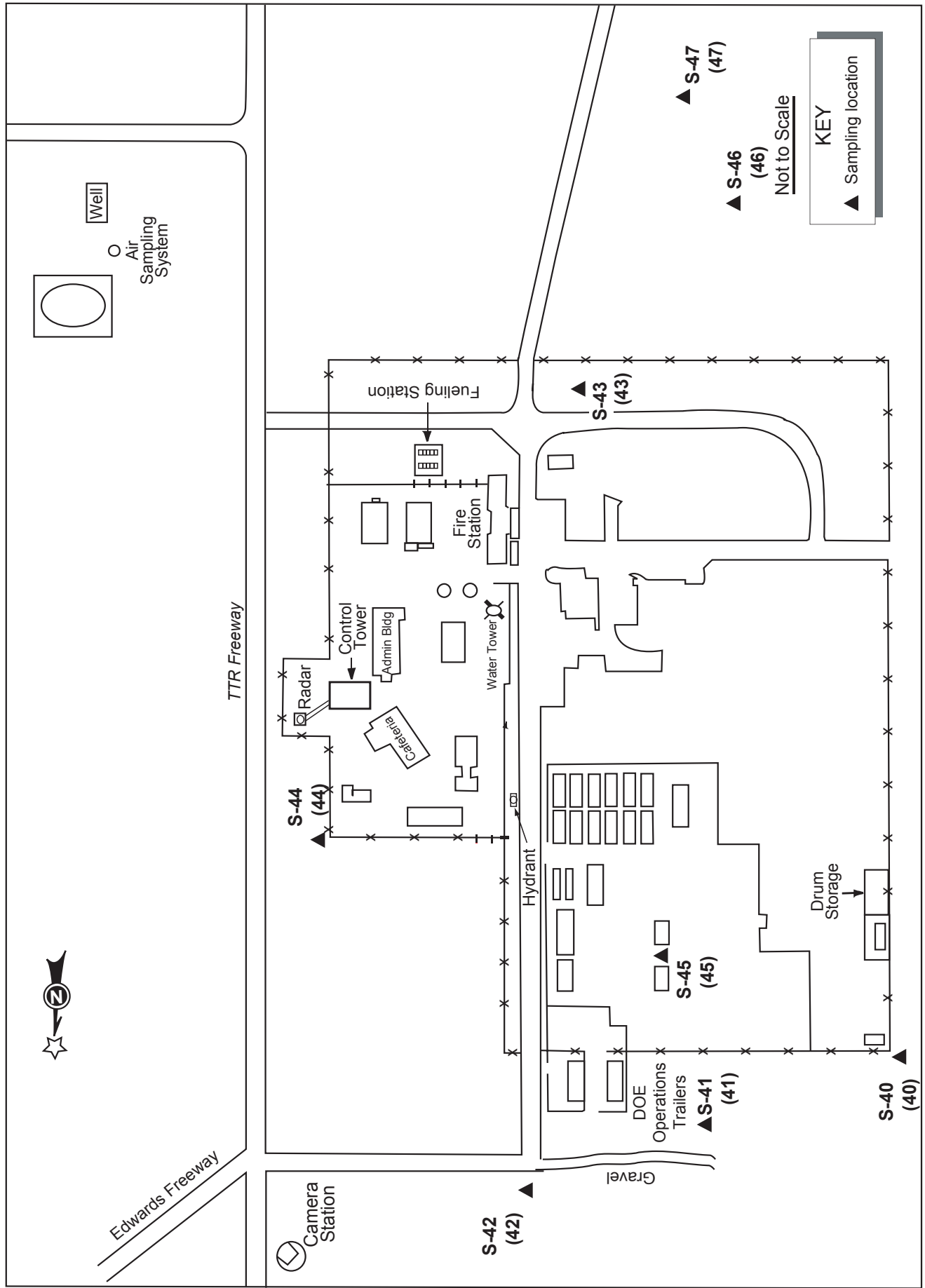
Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-40	Americium-241	pCi/g	0.0339 ± 0.0488	0.0472	0.0958	U
	Cesium-137	pCi/g	0.107 ± 0.0246	0.011	0.0227	
	Potassium-40	pCi/g	33.6 ± 2.34	0.0987	0.207	
	Uranium-235	pCi/g	0.118 ± 0.122	0.0804	0.163	UX
	Uranium-238	pCi/g	1.33 ± 0.783	0.399	0.81	
	Uranium	mg/kg	0.802	0.00598	0.0398	
S-41	Americium-241	pCi/g	-0.000941 ± 0.102	0.0682	0.138	U
	Cesium-137	pCi/g	0.301 ± 0.0378	0.0107	0.0219	
	Potassium-40	pCi/g	28.9 ± 2.14	0.0819	0.173	
	Uranium-235	pCi/g	0.0775 ± 0.0788	0.0784	0.159	U
	Uranium-238	pCi/g	0.581 ± 0.81	0.558	1.13	UX
	Uranium	mg/kg	0.688	0.00583	0.0388	
S-42	Americium-241	pCi/g	0.0141 ± 0.0582	0.058	0.118	U
	Cesium-137	pCi/g	0.358 ± 0.05	0.0144	0.0299	
	Potassium-40	pCi/g	29.9 ± 2.15	0.0995	0.214	
	Uranium-235	pCi/g	0.121 ± 0.144	0.099	0.202	UX
	Uranium-238	pCi/g	0.706 ± 0.784	0.483	0.984	UX
	Uranium	mg/kg	0.713	0.00595	0.0397	
S-43	Americium-241	pCi/g	0.0121 ± 0.0487	0.0435	0.088	U
	Cesium-137	pCi/g	0.0219 ± 0.0177	0.0101	0.0208	
	Potassium-40	pCi/g	29 ± 2	0.0958	0.2	
	Uranium-235	pCi/g	0.0713 ± 0.0795	0.0572	0.116	UX
	Uranium-238	pCi/g	1.26 ± 0.663	0.345	0.698	
	Uranium	mg/kg	1.04	0.00588	0.0392	
S-44	Americium-241	pCi/g	-0.0248 ± 0.0532	0.0524	0.106	U
	Cesium-137	pCi/g	0.0975 ± 0.0216	0.0109	0.0223	
	Potassium-40	pCi/g	32.1 ± 2.13	0.0861	0.181	
	Uranium-235	pCi/g	0.0625 ± 0.0884	0.0636	0.129	U
	Uranium-238	pCi/g	0.466 ± 0.704	0.423	0.854	UX
	Uranium	mg/kg	0.757	0.00594	0.0396	
S-45	Americium-241	pCi/g	-0.00927 ± 0.0478	0.0467	0.0946	U
	Cesium-137	pCi/g	0.0156 ± 0.0114	0.00971	0.02	U
	Potassium-40	pCi/g	30.4 ± 2.02	0.0805	0.17	
	Uranium-235	pCi/g	0.0813 ± 0.0928	0.0621	0.126	UX
	Uranium-238	pCi/g	0.989 ± 0.673	0.376	0.762	
	Uranium	mg/kg	1.09	0.00586	0.0391	
S-46	Americium-241	pCi/g	-0.0234 ± 0.0469	0.0452	0.0914	U
	Cesium-137	pCi/g	0.0235 ± 0.0175	0.0102	0.0208	
	Potassium-40	pCi/g	31.3 ± 2.12	0.0808	0.169	
	Uranium-235	pCi/g	0.0267 ± 0.097	0.0628	0.127	U
	Uranium-238	pCi/g	1.12 ± 0.677	0.358	0.724	
	Uranium	mg/kg	0.728	0.00595	0.0397	

See notes at end of table.

TABLE A-4. Radiological Results for Range Operations Center On-Site Soil Sampling Locations at TTR, 2004 (concluded)

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-47	Americium-241	pCi/g	0.0428 ± 0.0543	0.0485	0.0983	U
	Cesium-137	pCi/g	0.114 ± 0.0201	0.00992	0.0204	
	Potassium-40	pCi/g	33.9 ± 2.46	0.0849	0.179	
	Uranium-235	pCi/g	0.0791 ± 0.085	0.063	0.128	UX
	Uranium-238	pCi/g	1.03 ± 0.714	0.382	0.773	
	Uranium	mg/kg	0.557	0.00592	0.0394	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.
X = Presumptive evidence that analyte is not present.



01_B-4a.ai

FIGURE A-4a. Soil Sampling Locations in the Range Operations Center and Compound (on-site)
(Eight Locations)

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TABLE A-5. Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2004

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-02	Americium-241	pCi/g	0.014 ± 0.0351	0.0339	0.0686	U
	Cesium-137	pCi/g	0.342 ± 0.0384	0.00794	0.0162	
	Potassium-40	pCi/g	35 ± 2.38	0.062	0.129	
	Uranium-235	pCi/g	0.0839 ± 0.0811	0.0563	0.114	U
	Uranium-238	pCi/g	0.928 ± 0.544	0.288	0.582	
	Uranium	mg/kg	$1.01 \pm$	0.00596	0.0398	
S-03	Americium-241	pCi/g	0.0506 ± 0.0875	0.0732	0.148	U
	Cesium-137	pCi/g	0.333 ± 0.0361	0.0104	0.0212	
	Potassium-40	pCi/g	31.9 ± 2.28	0.0686	0.144	
	Uranium-235	pCi/g	0.119 ± 0.0991	0.0673	0.136	U
	Uranium-238	pCi/g	0.809 ± 0.886	0.56	1.13	UX
	Uranium	mg/kg	$0.823 \pm$	0.00598	0.0398	
S-04	Americium-241	pCi/g	0.022 ± 0.0575	0.0562	0.114	U
	Cesium-137	pCi/g	0.421 ± 0.0607	0.0138	0.0285	
	Potassium-40	pCi/g	33.9 ± 2.42	0.115	0.244	
	Uranium-235	pCi/g	0.231 ± 0.162	0.0997	0.203	
	Uranium-238	pCi/g	1.58 ± 0.981	0.48	0.976	
	Uranium	mg/kg	$0.729 \pm$	0.00589	0.0393	
S-09	Americium-241	pCi/g	0.532 ± 0.0891	0.0413	0.0834	
	Cesium-137	pCi/g	0.0911 ± 0.0161	0.0085	0.0174	
	Potassium-40	pCi/g	28.1 ± 2.03	0.0715	0.149	
	Uranium-235	pCi/g	0.0634 ± 0.0641	0.0519	0.105	UX
	Uranium-238	pCi/g	1.04 ± 0.553	0.31	0.625	
	Uranium	mg/kg	$0.612 \pm$	0.00598	0.0398	
S-10	Americium-241	pCi/g	-0.101 ± 0.0754	0.058	0.117	U
	Cesium-137	pCi/g	0.137 ± 0.0203	0.0087	0.0178	
	Potassium-40	pCi/g	33.1 ± 2.4	0.0707	0.147	
	Uranium-235	pCi/g	0.0564 ± 0.0992	0.0647	0.131	U
	Uranium-238	pCi/g	1.03 ± 0.755	0.445	0.899	
	Uranium	mg/kg	$0.831 \pm$	0.00596	0.0398	
S-38	Americium-241	pCi/g	0.0295 ± 0.0537	0.0524	0.106	U
	Cesium-137	pCi/g	0.311 ± 0.0334	0.00798	0.0163	
	Potassium-40	pCi/g	35.4 ± 2.65	0.066	0.138	
	Uranium-235	pCi/g	0.0831 ± 0.0808	0.0515	0.104	UX
	Uranium-238	pCi/g	0.852 ± 0.677	0.397	0.801	
	Uranium	mg/kg	$0.538 \pm$	0.00595	0.0397	
S-39	Americium-241	pCi/g	0.0715 ± 0.0663	0.0608	0.123	UX
	Cesium-137	pCi/g	0.336 ± 0.0369	0.0122	0.0252	
	Potassium-40	pCi/g	31.3 ± 2.1	0.0867	0.186	
	Uranium-235	pCi/g	0.0792 ± 0.0972	0.0769	0.156	UX
	Uranium-238	pCi/g	0.967 ± 0.653	0.47	0.952	
	Uranium	mg/kg	$0.735 \pm$	0.00596	0.0398	

See notes at end of table.

TABLE A-5. Radiological Results for Various On-Site Soil Sampling Locations at TTR, 2004 (concluded)

Location	Analyte	Units	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier
S-53	Americium-241	pCi/g	-0.043 ± 0.115	0.0967	0.197	U
	Cesium-137	pCi/g	0.167 ± 0.032	0.0169	0.035	
	Potassium-40	pCi/g	31.4 ± 2.4	0.129	0.276	
	Uranium-235	pCi/g	0.116 ± 0.154	0.0999	0.203	UX
	Uranium-238	pCi/g	0.874 ± 0.901	0.734	1.5	UX
	Uranium	mg/kg	$0.598 \pm$	0.00587	0.0391	

Notes: pCi/g = picocurie per gram
mg/kg = milligrams per kilogram
TTR = Tonopah Test Range
U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective Decision Level. For radiochemical analytes the result is less than the decision level.
X = Presumptive evidence that analyte is not present.

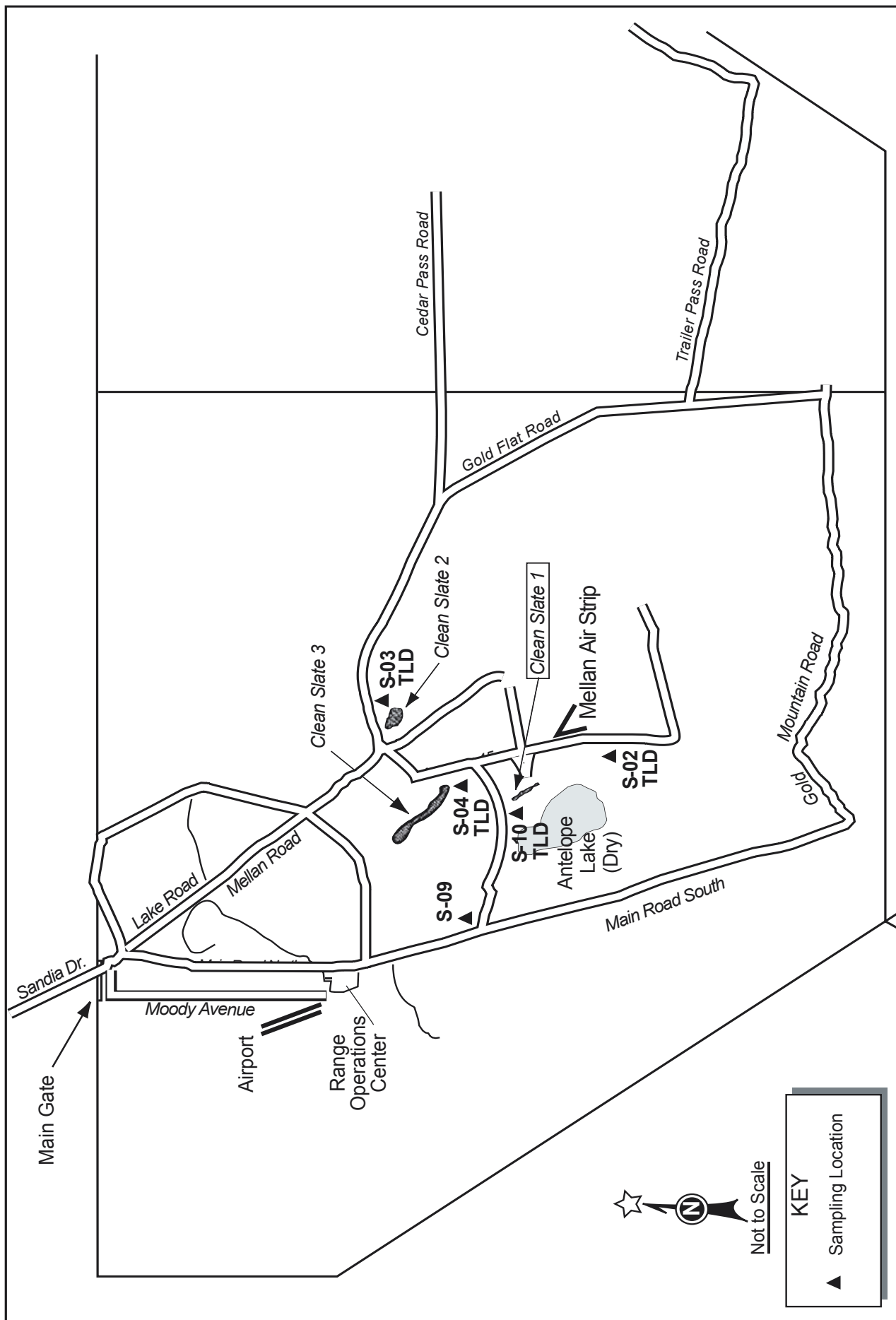
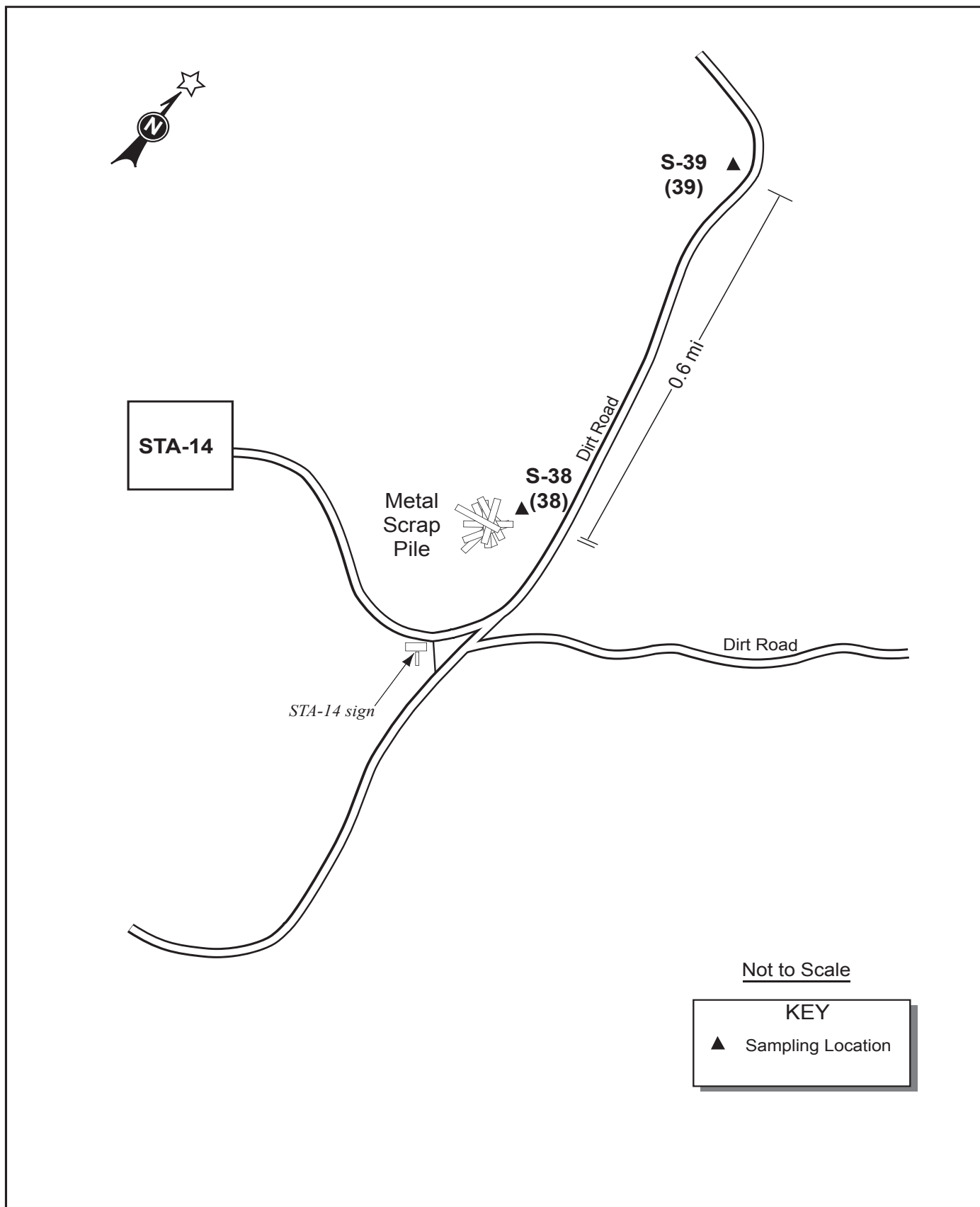


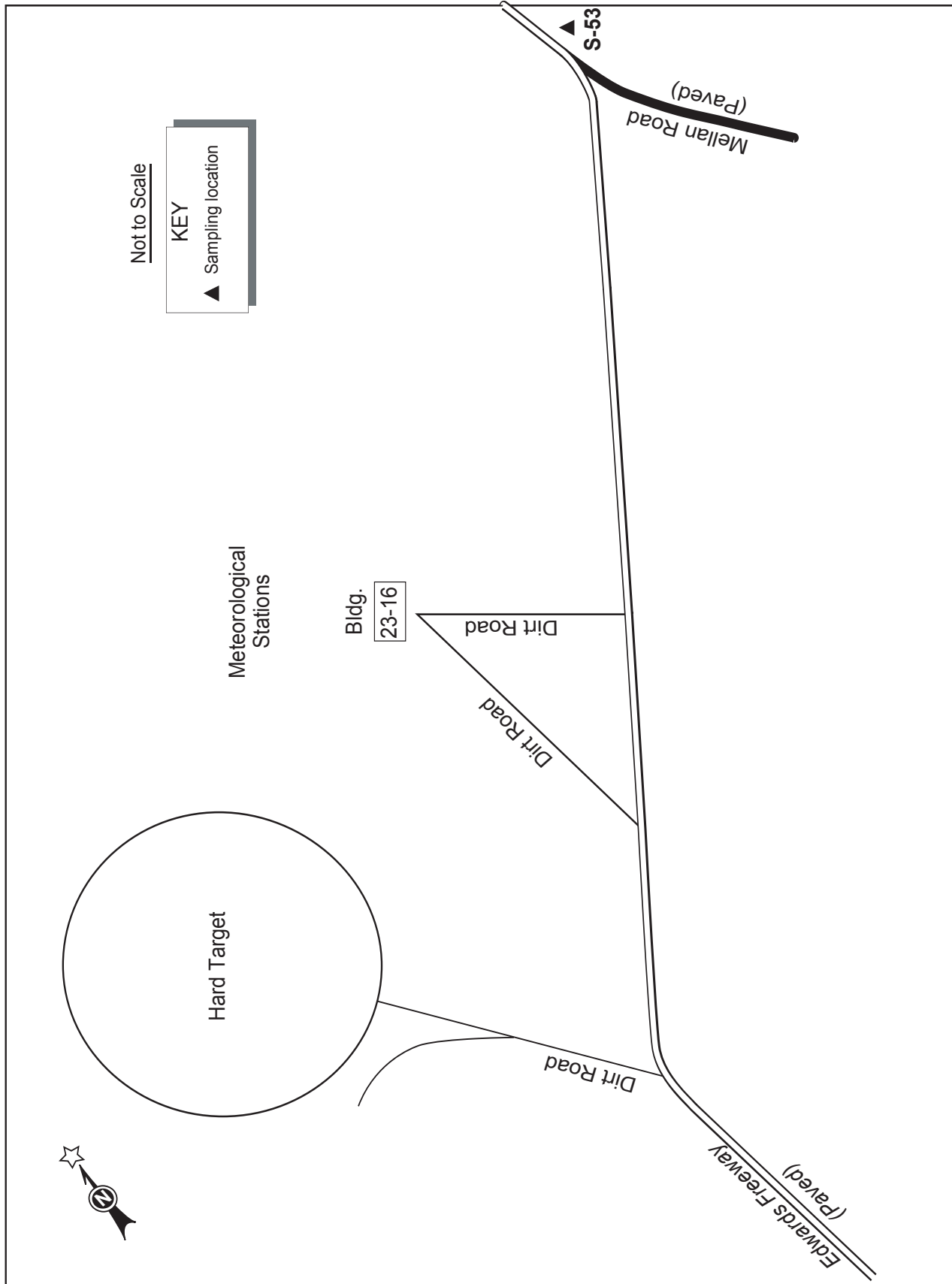
FIGURE A-5a. Various On-site Soil Sampling Locations
(Five Locations)

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01_B-5b.ai

FIGURE A-5b Various Soil Sampling Locations at Mellan Hill Area
(Two Locations)



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FIGURE A-5c. Soil Sampling Location Near the Hard Target/Depleted Uranium Area
(One Location)

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TABLE A-6. Radiological Replicate Sampling for Soil Sampling Locations, 2004

Location	Analyte	Units	Sample ID	Activity (± 2 σ)	Decision Level	Detection Limit	Lab Qualifier	Avg	Std Dev	Min	Max	CV%
Off-Site												
C-29	Americium-241	pCi/g	064741-01	0.014 ± 0.0676	0.0619	0.125	U	-0.01	0.03	-0.04	0.01	-3.06 %
			064741-02	-0.0372 ± 0.0619	0.0513	0.104	U					
			064741-03	-0.00241 ± 0.0185	0.0167	0.0338	U					
	Cesium-137	pCi/g	064741-01	0.112 ± 0.0187	0.00853	0.0176		0.14	0.05	0.11	0.19	0.34 %
			064741-02	0.19 ± 0.0237	0.0101	0.0209						
			064741-03	0.108 ± 0.0242	0.0106	0.0218						
	Potassium-40	pCi/g	064741-01	17.3 ± 1.31	0.0872	0.183		16.67	1.01	15.50	17.30	0.06 %
			064741-02	17.2 ± 1.3	0.0855	0.181						
			064741-03	15.5 ± 1.07	0.0948	0.197						
	Uranium	µg/g	064741-01	1.05	0.00594	0.0396		0.99	0.09	0.89	1.05	0.09 %
			064741-02	1.04	0.00587	0.0391						
			064741-03	0.891	0.00592	0.0394						
Perimeter												
P-11	Americium-241	pCi/g	064765-01	-0.0296 ± 0.0655	0.058	0.117	U	-0.02	0.02	-0.04	0.00	-0.96 %
			064765-02	0.00145 ± 0.0573	0.052	0.105	U					
			064765-03	-0.0421 ± 0.0617	0.0572	0.116	U					
	Cesium-137	pCi/g	064765-01	0.143 ± 0.0253	0.012	0.0247		0.10	0.04	0.07	0.14	0.38 %
			064765-02	0.0677 ± 0.0197	0.0114	0.0235						
			064765-03	0.0916 ± 0.0182	0.00916	0.0187						
	Potassium-40	pCi/g	064765-01	31 ± 2.08	0.0964	0.203		31.90	0.79	31.00	32.50	0.02 %
			064765-02	32.2 ± 2.35	0.0875	0.185						
			064765-03	32.5 ± 2.35	0.0684	0.142						
	Uranium	µg/g	064765-01	0.582	0.00587	0.0391		0.58	0.02	0.56	0.60	0.04 %
			064765-02	0.555	0.00595	0.0397						
			064765-03	0.602	0.00598	0.0398						
South Plume Area												
S-03	Americium-241	pCi/g	064752-01	0.0506 ± 0.0875	0.0732	0.148	U	0.06	0.03	0.04	0.10	0.47 %
			064752-02	0.0419 ± 0.026	0.0187	0.0377						
			064752-03	0.0977 ± 0.0857	0.0638	0.129	UX					
	Cesium-137	pCi/g	064752-01	0.333 ± 0.0361	0.0104	0.0212		0.34	0.01	0.33	0.35	0.03 %
			064752-02	0.351 ± 0.0397	0.012	0.0245						
			064752-03	0.348 ± 0.04	0.0106	0.0217						
	Potassium-40	pCi/g	064752-01	31.9 ± 2.28	0.0686	0.144		31.77	0.61	31.10	32.30	0.02 %
			064752-02	31.1 ± 2.01	0.104	0.217						
			064752-03	32.3 ± 2.36	0.0744	0.156						
	Uranium	µg/g	064752-01	0.823	0.00598	0.0398		0.84	0.03	0.82	0.88	0.04 %
			064752-02	0.878	0.00588	0.0392						
			064752-03	0.826	0.00583	0.0388						

See notes at end of table.

TABLE A-6. Radiological Replicate Sampling for Soil Sampling Locations, 2004 (concluded)

Location	Analyte	Units	Sample ID	Activity ($\pm 2 \sigma$)	Decision Level	Detection Limit	Lab Qualifier	Avg	Std Dev	Min	Max	CV%
Various On-Site												
S-09	Americium-241	pCi/g	064749-01	0.532 \pm 0.0891	0.0413	0.0834		0.69	0.27	0.53	1.00	0.39 %
			064749-02	0.997 \pm 0.173	0.057	0.115						
			064749-03	0.534 \pm 0.0451	0.0163	0.0329						
	Cesium-137	pCi/g	064749-01	0.0911 \pm 0.0161	0.0085	0.0174		0.10	0.02	0.09	0.12	0.18 %
			064749-02	0.121 \pm 0.0179	0.00848	0.0173						
			064749-03	0.0891 \pm 0.022	0.0107	0.0217						
	Potassium-40	pCi/g	064749-01	28.1 \pm 2.03	0.0715	0.149		28.67	0.81	28.10	29.60	0.03 %
			064749-02	29.6 \pm 2.24	0.0717	0.15						
			064749-03	28.3 \pm 1.81	0.0878	0.182						
	Uranium	μ g/g	064749-01	0.612	0.00598	0.0398		0.61	0.03	0.59	0.65	0.05 %
			064749-02	0.645	0.006	0.04						
			064749-03	0.586	0.00593	0.0395						
S-48	Americium-241	pCi/g	064758-01	0.00119 \pm 0.0394	0.0374	0.0756	U	0.00	0.01	-0.02	0.01	-7.17 %
			064758-02	-0.0174 \pm 0.0753	0.0629	0.128	U					
			064758-03	0.0103 \pm 0.0135	0.0161	0.0324	U					
	Cesium-137	pCi/g	064758-01	0.428 \pm 0.0591	0.0164	0.0336		0.50	0.11	0.43	0.62	0.22 %
			064758-02	0.441 \pm 0.04	0.00994	0.0204						
			064758-03	0.621 \pm 0.0648	0.0105	0.0215						
	Potassium-40	pCi/g	064758-01	28.8 \pm 1.98	0.12	0.254		29.87	1.01	28.80	30.80	0.03 %
			064758-02	30.8 \pm 2.24	0.0841	0.177						
			064758-03	30 \pm 2.09	0.0803	0.168						
	Uranium	μ g/g	064758-01	0.509	0.00596	0.0398		0.54	0.03	0.51	0.57	0.06 %
			064758-02	0.573	0.00599	0.0399						
			064758-03	0.533	0.00584	0.0389						

Notes: pCi/g = picocurie per gram μ g/g = microgram per gram

U = The analyte was analyzed for, but not detected, below this concentration. For organic and inorganic analytes the result is less than the effective decision level. For radiochemical analytes the result is less than the decision level.

X = Presumptive evidence that analyte is not present.

Std Dev = Standard deviation

CV = Coefficient of variation

TABLE A-7. TLD Measurements by Quarter and Location Class for Calendar Year 2004

Location Class	Location Number	1 st Quarter (91 Days)		2 nd Quarter (90 Days)		3 rd Quarter (91 Days)		4 th Quarter (118 Days)		Exposure Rate	
		Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	Exposure (mR)	Error	uR per hour	Error
On-Site	T-01	48.8	1.9	43.4	2.9	41.8	1.4	57.7	2.2	20.5	0.5
	T-02	45.1	1.4	39	3.5	36.4	1.4	56	1.6	18.9	0.5
	T-03	43.7	0.8	39.6	0.6	37.4	2.1	52.9	1.6	18.5	0.3
	T-04	43.4	0.8	39.6	1.9	36.3	1.3	57.5	2.2	18.9	0.4
	T-05	43.3	0.8	39.7	0.9	36.4	1.9	51.1	2	18.2	0.3
	T-07	41.2	1.9	37.5	6.8	33.2	0.9	48.5	1.8	17.1	0.8
	T-09	41.8	1.6	36.4	2.3	32.2	1	49.6	1.6	17.1	0.4
	T-10	44.7	1.1	37.8	2.6	36.6	2.1	53.9	2.8	18.5	0.5
	T-13	44.4	0.8	37	3.9	35.6	2.2	53.4	1.9	18.2	0.5
	T-14	40.8	0.8	35.3	2.3	33.3	1.9	50.7	2	17.1	0.4
	T-15	45.5	0.8	37.6	2.1	36.1	1.4	52	2.6	18.3	0.4
	T-16	8.6	1.1	37.3	1.8	34.8	0.9	55.3	1.2	14.5	0.3
	T-17	42.8	1.1	36.8	3.8	34.9	1.1	53.5	1.8	17.9	0.5
Off-Site	T-19	43.6	1.1	30.1	2	27	1.4	42.1	1.2	15.3	0.3
	T-21	43.6	2.4	35.6	3.7	*	*	*	*	18.2	1.0
	T-22	42.9	1.3	35.4	4.5	33.3	1.6	51.6	1.2	17.4	0.5
Perimeter	T-06	44.4	2.4	38.9	1.2	37.8	1.3	51.6	1.5	18.5	0.4
	T-08	40.5	0.8	34.9	3	32.2	2.3	50.9	1.2	16.9	0.4
	T-11	44.9	1	38.2	2.9	*	*	42.9	1.2	17.6	0.5
	T-12	43.9	0.9	37	2.4	37.7	1.1	55.2	1.6	18.6	0.3

Notes: mR = Milliroentgen (10^{-3} roentgen); μ R = microroentgen (10^{-6} roentgen)

* TLD lost, stolen, not exchanged, or data invalid and not used in calculation of average exposure rate

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TABLE A-8. Summary TLD Results for Calendar Year 2004, Tonopah Test Range

Location Class	Number of Locations	Mean Exposure Rate (uR/hour)	Median Exposure Rate (uR/hour)	Std Dev.	Minimum	Maximum
Community	3	17.0	16.5	1.5	15.3	18.2
Perimeter	4	17.9	18.0	0.8	17.0	18.6
On-Site	13	18.0	18.2	1.4	14.5	20.1

Notes: uR = microroentgen (10^{-6} roentgen)

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